

The relationship between Tooth Decay with Stress and BMI among elementary students: A cross-sectional study in Iran

Fatemeh Hosseinpour

Qazvin University of Medical Sciences

Rahman Panahi

Tarbiat modares University

Baharan Ranjbar Omid

Qazvin University of Medical Sciences

Erfan khorasani

Qazvin University of Medical Sciences

Leila Dehghankar (✉ Dehghan247@gmail.com)

Qazvin University of Medical Sciences

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Abstract

Background

Tooth decay is one of the most common chronic diseases among children worldwide. On the other hand, inappropriate Stress and BMI are risk factors that make children prone to diseases. Therefore, in this study, the relationship between tooth decay with Stress and BMI among children was examined.

Materials and Methods

This was a cross-sectional study of descriptive-analytical type. A total of 350 students referred to the clinic of the faculty of dentistry of Qazvin University of Medical Sciences in 1400 were selected through convenience sampling method to participate in the study. First, the students underwent a dental examination after measuring their height and weight. Then, two questionnaires of demographic information and Children's Stress Symptom Scale (CSSS) of Scherer and Ryan-Wenger were completed by the child's parents through self-reporting. The collected data were analyzed using SPSS software version 23 and using descriptive statistics and logistic regression.

Results

The BMI of the participating students was in the normal range. The prevalence of tooth decay among participating students was 76.9% (269 people). The mean and standard deviation of stress scores was 6.85 ± 4.01 out of 26, that was at a low level. Also, the mean and standard deviation of the BMI was 22.78 ± 5.28 , that was in the normal range. The results of logistic regression showed that the variables of "father's level of education", "family economic status", "experience of toothache in the past year", "oral health status", "frequency of tooth brushing", "flossing", "stress", and "BMI" were effective factors in tooth decay ($P < 0.05$).

Conclusion

Students who had inappropriate BMI, more stress, father with low level of education, family with poor economic status, experience of toothache past year, poor oral health status, and those who used less toothbrushes and floss had more tooth decay. Therefore, it is necessary to pay more attention to these students in designing and implementing educational programs to prevent tooth decay.

Introduction

One of the most important branches of public health is oral health. It has a great impact on people's health and affects the quality of life and general condition of the body (1) and is one of the most important aspects of personal health, so it is necessary to assess the oral health status in a society (2).

Various indicators are used to assess oral health. The DMFT index (The Decayed, Missing, and Filled Teeth) is one of the best epidemiological indicators in dentistry to determine the prevalence and severity of decay and can indicate the oral health status of people in the community. To calculate the DMFT index of a community, the total number of decayed, filled, and missing teeth in each community is counted and the average is calculated. If the condition of deciduous teeth is checked, it is displayed as a dmft index and the calculation method is similar to DMFT (3). In fact, DMFT is a simple, fast, and reliable index in determining oral health (4). One of the goals of the World Health Organization (WHO) has been to reduce the DMFT index in students to less than 3 by 2000 and to less than 2 by 2010 (5). Despite the relative improvement in the oral health status in the world, the resulting problems remain in effect in both developed and developing countries (6). For example, in a study conducted in Iran (2017), the prevalence of decay of deciduous and permanent teeth and whole teeth among 7–12 years old students was 75.2, 41.1, and 89.8%, respectively, and their mean DMFT + dmft was 4.44 (7). Therefore, in general, it can be said that during the last 35 years, the DMFT index in Iran has been increasing (8). The results of the study by Ditmyer et al. also showed that the prevalence of tooth decay among adolescents in the Nevada USA was 65% at younger ages and 77% at older ages (9). Statistics emphasize that tooth decay is the most common chronic disease among children worldwide, which, if left untreated, can lead to tooth tissue loss, microbial penetration into the pulp, pain, and eventually tooth loss (10).

Due to the importance of the role of teeth in various functions such as chewing, speech, facial growth and development and beauty of the appearance, therefore, gum disease, tooth loss and decay should be prevented (11). Tooth decay is a multiphase disease whose main causes are: destructive bacteria, destructive carbohydrates, sensitive teeth, and time. The onset and progression of the disease are strongly influenced by the consumption of carbohydrates in the diet. Epidemiological studies have also shown that behavioral, social, economic, and clinical factors are associated with the prevalence of tooth decay in children (12). Age, socioeconomic factors, poor brushing habits, consumption of harmful beverages, and inappropriate BMI were identified above all important factors involved in tooth decay (13–15). The BMI has been suggested as one of the related factors in tooth erosion (16).

Child obesity seems to have many negative effects on their oral health (17). The prevalence of childhood overweight and obesity has increased since the 1980s (18). Inappropriate eating habits have been suggested as a potential risk factor for tooth decay and obesity (19). Nevertheless, the number of tooth decay is related to the number of meals, the amount of dinner, dinner time, dinner time order, etc. in people with permanent and deciduous teeth (20). Eventually, tooth decay can lead to eating disorders as well as impact on eating habits (21). Some studies, including the study of Willershausen et al., showed a direct link between obesity and tooth decay, so that higher BMIs increased the risk of tooth decay in German children (22). However, some studies such as narksawat et al. showed an inverse relationship between these two indexes (23) and some other such as Sadeghi et al. and Kopycka et al. showed a lack of correlation (24, 25). Of course, a systematic review-meta-analysis by Hayden et al. showed that, in general, there was a significant relationship between childhood obesity and tooth decay (26).

Stress has been suggested as one of the factors affecting students' weight and oral health (27). Stress is defined as a physiological response to biological stressors such as trauma, surgery, and infection, and psychological stressors such as anxiety, fear, and social tensions resulting from a new job or increased family responsibilities (28). If stress is high, it causes feelings of anger, fear, failure, and is destructive (29). According to physicians' estimates, stress is the cause of 75% of medical complaints (30). Recent research has shown an increase in psychological problems such as stress among school-age children, which can be attributed to widespread life changes in developing societies such as changing friends and changing schools following multiple relocations, reduced family members, and so on (31). Today, stress is considered to be one of the major causes of many diseases (30).

Noradrenaline and corticotropin-releasing hormone reduce appetite in times of stress; while cortisol is known as an appetite stimulant during stress relief (32). In fact, extensive and complex internal and external factors affect appetite and, consequently, the amount and type of food consumed by humans. Stress is thought to affect human eating habits (33). In this regard, the study of Mejía-Rubalcava showed that students with moderate or high stress were at higher risk for tooth decay than students with low stress (34). However, in the study of Panagiotou et al., no relationship was found between tooth decay and stress in children (35).

Understanding and controlling risk factors are very important in preventing tooth decay and stopping or slowing their progression (36). The prevalence of overweight and obesity in childhood is also increasing (37). The experience of stress plays an important role in increasing future physical, psychological and social problems in children. It is therefore vital that families, teachers, and professional groups such as nurses recognize the stress in children (31). Also, studies on the relationship between tooth decay with stress and obesity have inconsistent and different results. Therefore, this study aimed to determine the relationship between tooth decay with Stress and BMI in children.

Methods

This was a cross-sectional study of descriptive-analytical type, which was conducted among 350 students referred to the clinic of the faculty of dentistry of Qazvin University of Medical Sciences in 1400.

In this study, samples were selected through convenience sampling method. So that 350 children referred to the clinic of the faculty of dentistry of Qazvin University of Medical Sciences, were selected and entered into the study after taking into account the inclusion criteria, obtaining informed consent, and providing full explanations about the study process. According to the results of the pilot study among 30 students (considering $r = 0.15$ for the correlation between BMI and tooth decay) and also using the sample size table for correlation researches, the minimum sample size required was estimated 175 people (38). Then, with Design Effect = 1.9, the sample size was calculated to be 332 people. Finally, considering the probability of 10% drop in the samples, 365 people were included in the study.

The inclusion criteria were: studying in the primary school in Qazvin, referring to the clinic of the faculty of dentistry of Qazvin University of Medical Sciences, the age range of 6–12 years, understanding

Persian language, and willingness to participate in the study. Also, lack of cooperation during the study, having a mental disorder, and incompletely answering to the questionnaire were considered as exclusion criteria.

A two-part questionnaire was used to collect data:

A) Demographic questionnaire including some questions about age, educational level, educational status, mother's education level, mother's job, father's education level, father's job, family economic status, breastfeeding in infancy, regular weekly exercise, regular walking, experience of toothache in the past year, oral health status, frequent use of toothbrushes per day, and flossing per day.

In addition, the weight of students was measured and recorded using Seca brand scales, without shoes, with the least clothing, and with an accuracy of 0.1 kg. Their height was measured and recorded using a non-elastic tape measure mounted on the wall, with an accuracy of 0.5 cm, without shoes, in a position that the students stuck their heels to the wall and their eyes were facing. Then BMI index was calculated by dividing students' weight in kg by height squared in meters. It should be noted that according to the recommendation of the WHO, BMI less than 18.5 was considered as low weight, BMI between 18.5 to 24.9 as normal, a BMI between 25 to 29.9 as overweight, and a BMI equal and above 30 as obese (39, 40). In order to calculate DMFT, filled, decayed, and missing teeth were counted and recorded.

B) To assess children's stress, the 24-part self-report questionnaire, the CSSS made by Scherer and Ryan-Wenger (2002) was used. This questionnaire examines stress-related experiences among children aged 7–12 years old with eleven symptoms related to emotional-cognitive symptoms and thirteen symptoms related to physical symptoms. So that the score "One" is considered for the existence of the sign and the score "zero" for the absence of the sign. The two options of "nausea and vomiting" and "grieving" were added after reviewing other studies, that in total 26 items were questioned. Stress scores ranged from zero to 26 and the presence of stress was reported at three levels: low, medium, and high (41). The reliability of the CSSS was evaluated and confirmed in a study by Skybo and Buck (2007) with a Cronbach's alpha coefficient of 0.88 (42). The questionnaire used by Valizadeh et al. was also translated into Persian and the validity of the translation and the validity of the content were examined. The reliability of this tool was also confirmed in this study with a Cronbach's alpha coefficient of 0.76 (43). In the present study, Cronbach's alpha coefficient for this questionnaire was calculated to be 0.84.

Regarding ethical considerations in this research, first the research project number was received from the Vice Chancellor for Research and Technology of Qazvin University of Medical Sciences (with ethics code IR.QUMS.REC.1396.486). Then the necessary coordination was done with the clinic of the faculty of dentistry of Qazvin University of Medical Sciences. The purpose of this study was also explained to the parents of children and their consent was obtained in writing. Answering the questionnaires was self-report in which all parents were asked to answer the questions with complete honesty. They were also assured that all the information requested in the questionnaire would be used confidentially without mentioning the names of the individuals. It should be noted that the questionnaire of demographic information and the CSSS was completed by the child's parents.

After collection, the data were entered into SPSS software version 23 and analyzed using descriptive statistics and logistic regression. It should be noted that entering variables was performed simultaneously through the method of Generalized Linear Models (GLM) with Binary logistic regression response and the last class of variables was selected as the reference class. In this study, tooth decay as a dependent variable and variables of age, educational level, child's educational status, parents' education level, parents' job, family economic status, frequency of tooth brushing, flossing, oral health status, breastfeeding in infancy, regular weekly exercise, regular walking, experience of toothache in the past year, BMI, and stress were entered to the model as independent variables. In addition, the level of significance in this study was less than 0.05.

Results

After completing the questionnaires, the final analysis was performed on the data obtained from 350 questionnaires (response rate: 95.9%). Of these, 42% (147) of students reported their father's education at the diploma level, and 76% (266) were in the first to third grades. Only 6.6% (23 people) reported excellent oral health status. Table 1 shows the other demographic (qualitative) characteristics of the students studied. The results also showed that the prevalence of tooth decay among participating students was 76.9% (269 people).

Table 1
Frequency distribution of students in terms of demographic variables

Variable	Category	Frequency	Percentage
Father's level of education	Under Diploma	136	38.9
	Diploma	147	42
	Associate Degree	38	10.9
	Bachelor's degree and higher	29	8.2
Grade	First to third	266	76
	Fourth to sixth	84	24
Oral health status	Excellent	23	6.6
	Good	112	32
	Medium	203	58
	Weak	12	3.4
Flossing	Yes	283	80.9
	No	67	19.1
Frequency of tooth brushing	Twice a day or more	45	12.9
	Less than twice a day	207	59.1
	Sometimes	98	28
The child's educational status	Excellent	238	68
	Good	87	24.9
	Medium	25	7.1
Mother's job	Housekeeper	304	86.9
	Employed	46	13.1
Mother's level of education	Under Diploma	112	32
	Diploma	164	46.9
	Associate Degree	28	8
	Bachelor's degree and higher	46	13.1
Family economic status	Excellent	26	7.4
	Good	115	32.9
	Medium	186	53.1

Variable	Category	Frequency	Percentage
	Weak	23	6.6
Breastfeeding in infancy	Yes	320	91.4
	No	30	8.6
Regular weekly exercise	Yes	180	51.4
	No	170	48.6
Regular walking	Yes	152	43.4
	No	198	56.6
Experience of toothache in the past year	Yes	274	78.3
	No	76	21.7
Mother's job	Employed	274	78.3
	Unemployed	39	11.1
	Retired	37	10.6
Gender	Girl	187	53.4
	Boy	163	46.6

(Table 1)

Table 2 shows the mean and standard deviation of other variables among the students studied. The results showed that the mean and standard deviation of stress scores among participants was 6.85 ± 4.01 which was at a low level. Also, the mean and standard deviation of BMI among all participants was 22.78 ± 5.28 , so that 17.7% (62 people) were lean, 48.3% (169 people) normal, 24.3% (85 people) had overweight, and 9.7% (34 people) were obese.

Table 2
Mean and standard deviation of other variables among the studied students

Variable	Minimum	Maximum	Mean	SD
Child age	6.00	12.00	8.50	1.23
Stress	0.00	22.00	6.85	4.01
BMI	9.01	27.05	16.59	3.12

(Table 2)

Table 3 shows the results of logistic regression to determine the factors affecting tooth decay among students. As the results show, the variables of father's level of education, family economic status, experience of toothache in the past year, oral health status, frequency of tooth brushing, flossing, stress, and BMI were effective factors in tooth decay ($P < 0.05$):

Table 3

Factors affecting tooth decay among students in the test of GLM with Binary logistic regression response

Parameter Estimates			
Variable	Category	OR (95% CI)	Sig.
Mother's level of education	Under Diploma	0.392 (0.057–2.621)	0.632
	Diploma	0.932 (0.513–1.699)	0.146
	Associate Degree	1.113 (0.135–9.018)	0.131
	Bachelor's degree and higher		
Mother's job	Housekeeper	1.097 (0.011–0.179)	0.161
	Employed		
Father's level of education	Under Diploma	2.409 (0.712–6.017)	0.011
	Diploma	1.129 (1.031–1.906)	0.003
	Associate Degree	0.757 (0.671–0.950)	0.348
	Bachelor's degree and higher		
Father's job	Employed	0.618 (0.310–1.224)	0.983
	Unemployed	0.284 (0.079–1.182)	0.073
	Retired		
Family economic status	Excellent	0.378 (0.078–1.806)	0.015
	Good	0.469 (0.416–1.611)	0.042
	Medium	1.104 (0.699–1.981)	0.466
	Weak		
Child's educational status	Excellent	0.334 (0.211–1.340)	0.101

Parameter Estimates			
	Good	0.461 (0.127–1.747)	0.166
	Medium		
Grade	First to third	1.042 (0.848–1.350)	0.266
	Fourth to sixth		
Breastfeeding in infancy	Yes	0.583 (0.207–1.648)	0.965
	No		
Regular weekly exercise	Yes	1.527 (0.744–2.065)	0.319
	No		
Regular walking	Yes	0.332 (0.202–1.331)	0.474
	No		
Experience of toothache in the past year	Yes	1.457 (0.702–1.276)	0.018
	No		
Oral health status	Excellent	0.283 (0.068–1.171)	0.010
	Good	0.318 (0.105–0.976)	0.019
	Medium	0.617 (0.553–1.722)	0.335
	Weak		
Frequency of tooth brushing	Twice a day or more	0.327 (0.084–1.266)	0.036
	Less than twice a day	0.555 (0.455–1.135)	0.041
	Sometimes		
Flossing	Yes	0.551 (0.399–1.397)	0.025
	No		

Parameter Estimates			
Gender	Girl	0.541 (0.391–1.378)	0.254
	Boy		
Child's age		0.553 (0.408–1.407)	0.132
BMI		1.211 (0.966–1.349)	0.035
Stress		1.104 (0.703–1.981)	0.048
(Intercept)		-207.253	0.373

- "Father's level of education" was one of the factors affecting tooth decay, so that the probability of tooth decay in children whose fathers had under diploma and diploma degree was 2.409 and 1.129 times compared to those whose fathers had a bachelor's degree and higher, respectively.

- "Family economic status" was one of the factors affecting tooth decay, so that the probability of tooth decay in children whose family economic status was excellent and good was 0.378 and 0.469 times compared to those whose family economic status was poor, respectively.

- The variable of "experience of toothache past year" was one of the factors affecting tooth decay, so that the probability of tooth decay in children who had experienced toothache past year was 1.458 times compared to those without experiencing toothache past year.

- "Oral health status" was one of the factors affecting tooth decay, so that the probability of tooth decay in children with excellent and good oral health status was 0.283 and 0.318 times compared to those with poor oral health status, respectively.

- "Frequent use of toothbrush" was one of the factors affecting tooth decay, so that the probability of tooth decay in children whose daily brushing was "twice or more" or "less than twice a day" was 0.327 and 0.555 times compared to those who occasionally used toothbrushes, respectively.

- "Flossing" was one of the factors affecting tooth decay, so that the probability of tooth decay in children who used flossing was 0.551 times compared to those who did not floss.

- The variables of "Stress" and "BMI" were other factors affecting tooth decay, so that by increasing the score of these variables by one unit, the probability of students' tooth decay increased by 1.211 and 1.104 times, respectively. In addition, other demographic variables had no effect on tooth decay ($P > 0.05$).

(Table 3)

Discussion

This study aimed to determine the relationship between tooth decay with stress and BMI in elementary school students. Based on the results of logistic regression, the following variables were effective factors in tooth decay: father's level of education, family economic status, experience of toothache in the past year, oral health status, frequency of tooth brushing, flossing, stress, and BMI.

The results of the present study showed that the prevalence of tooth decay among the participating students was 76.9%, which was at a high level. One of the possible reasons for this high prevalence can be the sampling at the clinic level because people usually go to medical centers who have dental problems. Therefore, the prevalence of tooth decay among these people is higher than the samples available in school. The results of this section were consistent with the results of studies by Basir et al. (36), Hamissi et al. (44), Panahi et al. (45), Nabipour et al. (46), and Namal et al. (47), that this rate in these studies have been reported 75.6%, 75.5%, 75.2%, 71.8%, and 76.8%, respectively. Also, the prevalence of tooth decay in the studies of Alghamdi et al. (48), Jain et al. (49), Kalantari et al. (50), Nematollahi et al. (51), Dawkins et al. (52), and Singh et al. (53) were estimated 48.4%, 63.6%, 83.9%, 49.7% and 40%, respectively, which were not consistent with the results of the current study. Possible reasons for this discrepancy include the following: the age of the children studied in these studies was different from the present study, differences in oral health status and dental care between cultures, cities, villages, and countries around the world.

The results of the present study showed that "stress" was at a low level among the participating students. One of the possible reasons for the low level stress in the present study could be the completion of the stress questionnaire by parents, because sometimes the internal states of children's stress may be ignored by parents. In line with the present study, a study by Talbot et al. reported the prevalence of stress at a low level (54). The results of the studies of Tanganelli et al. (55) and Calais et al. (56) were not in line with the results of this part of the present study. Possible reasons for this discrepancy may be due to differences in factors such as the age of children and stress assessment tools in these studies compared to the present study.

The results of the present study indicated that the mean BMI among the participating students was in the normal range. In this regard, it can be said that the majority of participating students probably had healthy eating habits and tried to do sports such as walking or exercise even during a coronavirus pandemic. The approach of parents and their educators in the field of proper nutrition can also be effective in this regard. This results were consistent with the results of studies by Panahi et al. (40), Zare-Zardiny et al. (57), Wei et al. (58), Liang et al. (59), Mohammadi et al. (60), and Jang et al. (61). In terms of BMI in all the above studies, the majority of people were in the normal range.

The results of the present study revealed that the "father's level of education" was one of the factors affecting tooth decay. This part of the results was consistent with the results of studies by Chu et al. (62),

Panahi et al. (45), Nematollahi et al. (51), KAZEROUNI et al. (63), Namal et al. (47), Mohebi et al. (64), and Kalantari et al. (50). The results of the present study also indicated that the family economic status was one of the factors affecting tooth decay. The results of the studies of Alghamdi et al. (48), Chu et al. (62), Goodarzi et al. (76), Jamelli et al. (65), and Prashanth et al. (66) were in line with these results. In justifying the possible reasons for these two results, it can be pointed out that as the father's level of education increases, his level of awareness increases. Also, with the increase in the father's level of education, the family economic status will probably improve and the rate of visits to the dentist for examination increases. Finally, the combination of three factors of higher awareness, better economic status, and more visits to the dentist, will improve the oral health status of children.

The results of the present study showed that the experience of "toothache past year" was one of the factors affecting tooth decay. This result may indicate that factors such as adopting oral health behaviors and properly educating them to children, taking seriously the initial pain reported by children and timely action by parents can reduce the rate of primary decay. In this regard, the studies of Faezi et al. (67), Ferraz et al. (68), and Adeniyi et al. (69) also reported similar results to those of the present study. Also in line with the present study, in the study of Prasai Dixit et al., It was pointed out that toothache among children aged 8 to 12 years had a direct effect on the rate of tooth decay (70).

Based on the results of the present study "oral health status" was one of the factors affecting tooth decay. Mohiuddin et al. (71), Schwendicke et al. (72), and Akinyamoju et al. (73) reported similar results on the relationship between oral health and tooth decay. They stated that poor oral health status in children and adolescents, along with factors such as irregular dental examinations and less awareness of the principles of oral health, can affect the rate of tooth decay. However, contrary to the results of the present study in the study of Panagiotou et al. (35), no relationship was observed between oral health and tooth decay in children. One of the possible reasons for this discrepancy could be the difference between the two studies in terms of the sample population, because the above study was conducted among adolescents in addition to children.

According to the results of the present study, the frequency of tooth brushing and flossing were other factors affecting tooth decay. In this regard, it can be said that these two results were largely expected, indicating the vital and important role of oral health behaviors in promoting dental health. This part of the results was consistent with the results of studies by Guadagni et al. (74), Taani et al. (75), Faezi et al. (67), Goodarzi et al. (76), and Prasai Dixit et al. (70).

As the results of the present study revealed, stress was one of the factors affecting tooth decay. Similarly, in the study by Cynthia et al., students with moderate and high levels of stress were at greater risk for tooth decay than those with low levels of stress (34). The results of the studies of Masoudi et al. (77), Kisely et al. (78), Delgado et al. (79), Jain et al. (80), and Honkala et al. (81) were in line with these results. Contrary to the results of the current study, in the studies of Hubbard and Workman (82) and Panagiotou et al. (35), no relationship was observed between stress and tooth decay in children. In justifying this discrepancy, we can point to possible differences in the rate of tooth decay and stress, as well as

differences in stress measuring tools and indexes used in these two studies compared to the present study. Also, differences in the family economic status, students' ages, cultures and educational systems of different regions, and different approaches of parents and educators regarding stress and oral health of students could also be effective in this regard.

The results of the present study showed that BMI was one of the factors affecting tooth decay, so that students with higher BMI had more decayed teeth. In this regard, it can be said that these children probably had unhealthy eating habits than others, so the risk of tooth decay was higher among them. Similar to these results, in the studies of Amiri et al. (83), Bafti et al. (84), Yan-Fang Ren et al. (85), Thomas Mod er et al. (86), Kor et al. (87), Wei et al. (58) also, more tooth decay was observed among children with higher BMI.

In contrast, studies by Mohammadi et al. (60), Liang et al. (59), and Jang et al. (61) reported an inverse relationship between BMI and tooth decay. They stated that obese children with higher BMI had less tooth decay and those with lower BMI showed more signs of decay. The reason could be the reduction in the intake of essential minerals such as calcium, that could be due to poor economic status and nutritional problems of children. However, Wu et al. (88) and Dikshit et al. (89) in their studies did not report any relationship between BMI and tooth decay. In general, all the studies mentioned in this paragraph were inconsistent with the results of the present study. In justifying this discrepancy, the possible differences in the rate of tooth decay and the prevalence of different categories of BMI in these studies compared to the present study can be considered. Also, differences in the family economic status, students' ages, cultures and educational systems of different regions, and different approaches of parents and educators regarding stress and oral health of students could also be effective in this regard.

It seems that the present study is the first study that simultaneously has measured the effect of two variables of body mass index and stress on tooth decay. It is suggested that the results of this study be used in designing interventions to prevent tooth decay among students. In addition, the target group in this study were students referred to the pediatric dental clinic of the faculty of dentistry of Qazvin University of Medical Sciences. Therefore, the results of this study cannot be generalized to other groups of students. Therefore, it is recommended that this study be conducted among students in other cities as well as among different groups of students (in terms of education, gender, age, and place of residence). One of the important limitations of this study was that due to the covid-19 pandemic and school closures, sampling was done through convenience sampling method at the pediatric dentistry clinic. In addition, the relatively small number of samples and self-reported data collection were other limitations of this study.

Conclusion

Students who had higher BMI, stress, father with lower education, family with poor economic status, experience of toothache in the past year, poor oral health status, and those who used less toothbrush and floss, had more tooth decay. Therefore, it is necessary to pay more attention to these students in

designing and implementing educational programs to prevent tooth decay. In addition, by preparing and formulating programs to promote a healthy diet and exercise, identify children with stress symptoms and control it by school counselors, effective actions can be taken to reduce dentistry costs and promote children's oral health.

Declarations

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Authors' contributions

This study substantial contributions to the conception design of the work F.H. and L.D. , R.P. , the acquisition, analysis and interpretation of data R.P. and the creation of new software used in the work, F.H. , E.KH. , B.RO. , and LD; have drafted the work or substantively revised it L.D. and R.P. , F.H.

All authors have read and approved the manuscript.

Availability of data and materials

The data that support the results of this study are available by [Leila Dehghankar] but there are restrictions on the availability of this data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of [Leila Dehghankar].

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Ethics approval and consent to participate

Regarding ethical considerations in this research, first the research project number was received from the Vice Chancellor for Research and Technology of Qazvin University of Medical Sciences (with ethics code IR.QUMS.REC.1396.486). Then the necessary coordination was done with the clinic of the faculty of dentistry of Qazvin University of Medical Sciences. The purpose of this study was also explained to the parents of children and their consent was obtained in writing.

Consent for publication

Not applicable.

Competing of interest:

There was no conflict of interest.

Author details

¹Student Research Committee, School of Nursing & Midwifery, Qazvin University of Medical Sciences, Qazvin, Iran. ²P.h.D, Department of Health Education & Promotion, School of Medical Sciences, Tarbiat modares University, Tehran, Iran. ³Assistant Professor of Restorative Dentistry, Department of Restorative Dentistry, School of Dentistry, Qazvin University of Medical Sciences, Qazvin, Iran. ⁴Student of dentistry, student Research Committee, Qazvin University of Medical Sciences, Qazvin, Iran. ⁵MSc, Department of Nursing, Dental Caries Prevention Research Center, Faculty of Nursing and Midwifery, Qazvin University of Medical Sciences, Qazvin, Iran.

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