The dietary patterns of 12-year-old children and their awareness about the effect of diet on oral health in Iran

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Original Article

Abstract

BACKGROUND AND AIM: Foods containing carbohydrates have a major effect on the pathogenesis of dental caries. There is a direct correlation between frequency of consumption of foods containing sugar and dental caries. The purpose of this study was to evaluate the dietary patterns of 12-year-old children and their awareness about the effect of diet on oral health in Iran.

METHODS: A cross-sectional survey was conducted on 1554 children aged 12 years in 5 provinces in Iran. Subjects were selected based on a multistage stratified cluster random sampling procedure. Data were collected by a culturally adapted questionnaire that included demographic data (such as sex, age, parents' job and education, and area), and questions about the frequency of consumption of cariogenic and non-cariogenic foods during the previous week.

RESULTS: The mean score of diet-related behavior was 17.5 ± 5.9 (from 40). Approximately, 31.0% of children ate sweet foods (chocolate/cake/biscuit/chips), and 39.4% drank soft drinks (sugared tea or coffee or milked/soda/syrup) more than once a day, while 15 percent of children consumed fresh fruit and raw vegetables more than once a day. Students living in urban areas had higher scores in diet-related behavior (18.3 ± 5.4 vs. 16.1 ± 6.4, P < 0.001). The mean scores in Tehran (the Capital of Iran) was significantly higher than other urban areas. In rural areas, the mean scores of villages in Esfahan province, Iran, were higher than other villages. Children whose mothers were employed, and had higher education had significantly higher scores (P = 0.030 and P = 0.012, respectively). Sex and fathers' education and job had no significant association with diet-related behavior.

CONCLUSION: The results showed that dietary patterns was not satisfactory, and the level of consumption of cariogenic foods was high. Study findings recommend that school-based oral health programs should be designed for modifying the dietary habits in Iran.

KEYWORDS: Oral Health; Dental Caries; Cariogenic Agents; Diet; Food Habits

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Globally, the most prevalent oral diseases in children is dental caries,[1] which is a multi-factorial disease.[2] Recent studies indicate that tooth decay is on the rise in the world.[3] Studies have shown a correlation between the frequency of consumption of sugars and other fermentable carbohydrates and dental caries. Besides sugars, other factors such as

food or liquid form, duration of remaining in mouth, the composition of nutrients, eating sequence, the flow of saliva and hygiene of mouth are involved in the process of decay.[4]

The time of remaining of the food on the teeth depends on the form of the carbohydrate. Liquid sugar are transmitted through the oral cavity relatively quickly with restricted exposure time or adherence to

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the teeth surfaces compared to long-term sources of sugars, such as hard candy and breath mints. Also, it seems the frequency of consumption is a major factor in cariogenicity of the food,[4,5] and the exposure time may be affected by frequency and quantity of fermentable carbohydrates consumed.[4]

In contrast to carbohydrates, some foods are non-cariogenic, such as cheese, raw vegetables, meat rolls and fresh fruits. Epidemiological studies indicate that fresh fruits are not associated with dental caries, and increasing consumption of fresh fruits designed to replace soft drinks (sugared tea or coffee or milk/soda/syrup) in the diet is presumably to reduce dental caries rate in a population.[6]

A study showed that there was a consistent evidence of moderate quality supporting a relationship between the amount of sugars intake and tooth decay development.[7] The results of a systematic review showed that dental caries was lower when free-sugars intake was < 10% of total energy.[8] The results of studies in Zimbabwe,[9] Nairobi,[10] and Laos[1] showed a significant association between regular consumption of sugary products and a high Decayed, Missing, Filled Teeth index (DMFT) among students.

Twelve-year-old represent a standard age group that is used by the World Health Organization (WHO) to evaluate and compare dental caries.[11] In a national study by WHO in Iran (1989–1999), the prevalence of dental caries in 12-year-olds was reported to be 52.3%.[12] Despite the high rate of dental caries in this age group, there are no socio-epidemiologic data on oral health behaviors of children at national level. However, to determine the habits associated with dental caries risk in students, a diet history about food intake patterns, diet adequacy and consumption of fermentable carbohydrates is necessary. Therefore, this study was conducted to collect information about diet practice of 12-year-old children in different areas in Iran. Such data would be essential for health authorities to design educational school-based oral health programs.

Methods

This cross-sectional study was approved by the Research Center of Oral Medicine, Kerman University of Medical Sciences, Iran (Code of ethics IR.KMU.rac.1394.26). Included in this study were 1691 twelve-year-old children studying in the sixth grade in various schools in five provinces (7 urban and 8 rural areas) of Iran in 2013-2014. The sample size was determined based on WHO guidelines in relation to the oral cavity diseases.[11] According to these guidelines, to obtain a sample representing a nation, in any age group, according to the expected incidence and severity of the disease (in this study, tooth decay), 4 clusters in the capital, two clusters in two major cities (each including two clusters), and a cluster of four villages in different parts of the area should be selected. The number in each cluster contains 25 to 50 individuals. In present study, given the high prevalence of caries, in addition to the capital (Tehran), six urban areas and eight rural regions in four provinces (Khorasan in the northeast, Isfahan in the center, Hormozgan in the south and Kerman in the southeast) were selected. After that, a multistage stratified random sampling technique was conducted in each province and cluster (school). In each stratum, a number of schools were chosen, and in each school a random sample of sixth grade students, according to the number of students in each school were selected.

A questionnaire was used for evaluation of diet-related practice of 12-year-old schoolchildren. The questions were about the frequency of taking of cariogenic and non-cariogenic foods during the previous week. The questionnaire was designed based on a systematic review of relevant articles,[13] and was translated and back-translated using standard methods from English to Persian, and the face validity and reliability of the questionnaire was evaluated. For this purpose, a preliminary study was conducted on 30 students in sixth grade with an interval of three weeks. The children's ability in order

to understand the questions and fulfill the questionnaire without any help was assessed. To test the reliability, the consistency rate in responses between the two intervals was measured, which was over 80% (by interclass correlation coefficient).

For assessment of reliability, Cronbach's alpha was computed, and reported as desirable (0.88).[14] The questionnaire included demographic data (such as sex, age, parents' job and education, and area of living), and the frequency of consumption of cariogenic and non-cariogenic foods during the previous week. Also, for further evaluation between dietary behaviors and awareness, three questions about knowledge on cariogenic foods were asked.

After coordination with the school authorities and student consent, the questionnaires were filled by children in school, supervised by teachers. The subjects received a full explanation for completing the questionnaires. The questions about diet practice were eight, and the answers to each questions were "several times a day, one time a day, several times a week, one time a week, seldom, and never". Therefore, the variable "diet practice" was measured with a score

range of 0-40 to answers to questions about the frequency of consumption of cariogenic (chocolate, cake, toffee, sugared tea and milk) and non-cariogenic (fresh fruit and raw vegetables) foods during the previous week. For analysis of cariogenic foods, a score of 5 was given to the least frequent intake and a score of 0 was given to the most frequent intake, and for non-cariogenic items a score of 5 was given to the most frequent intake, and a score of 0 was given to the least frequent intake.

Data were processed and analyzed with SPSS (version 21, IBM Corporation, Armonk, NY). The statistical evaluation of means was done by analysis of variance (ANOVA), and the chi-square test was applied for comparison of proportions. In order to assess the relative effect of sociodemographic and "healthy diet practice" (HDP), linear regression was carried out. A P-value of < 0.05 was defined significant.

Results

The response rate was 92 percent of the 1691 students, and questionnaires of 137 students, which were incorrectly filled, were not analyzed. Of the 1554 students surveyed in five provinces, 49.5% were male. Around 61.0% were from urban areas (Table 1).

Table 1. The basic demographic of the subjects according to living in urban and rural region
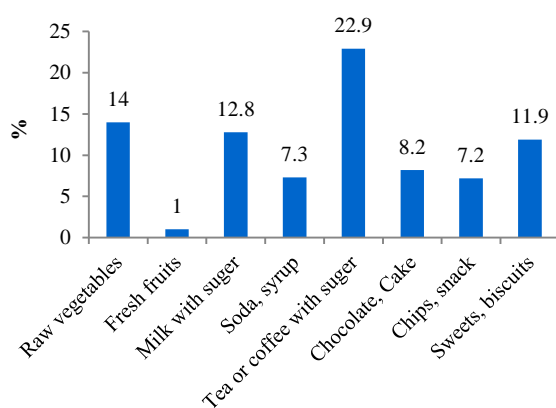
Variable	Urban areas [n (%)]	Rural areas [n (%)]	Total [n (%)]
Sex			
Male	465 (48.9)	305 (50.5)	770 (49.5)
Female	485 (51.1)	299 (49.5)	784 (50.5)
Mother's education			
Illiterate	35 (3.7)	49 (8.1)	84 (5.4)
1-6 classes	114 (12.0)	101 (16.7)	215 (13.8)
7-9 classes	91 (9.6)	127 (21.1)	218 (14.0)
10-11 classes	79 (8.3)	125 (20.7)	204 (13.1)
12 class	484 (50.9)	165 (27.3)	649 (41.8)
University	147 (15.5)	37 (6.1)	184 (11.8)
Father's education			
Illiterate	34 (3.6)	41 (6.8)	75 (4.8)
1-6 classes	113 (11.9)	94 (15.6)	207 (13.3)
7-9 classes	91 (9.6)	132 (21.9)	223 (14.4)
10-11 classes	34 (3.6)	88 (14.6)	122 (7.9)
12 class	504 (53.1)	202 (33.4)	706 (45.4)
University	174 (18.3)	47 (7.8)	221 (14.2)
Mother's job			
Housekeeping	612 (64.4)	448 (74.2)	1060 (68.2)
Specialized manual jobs	125 (13.2)	76 (12.6)	201 (12.9)
Specialized non-manual jobs	197 (20.7)	74 (12.3)	271 (17.4)
Managerial jobs	16 (1.7)	6 (1.0)	22 (1.4)
Father's job			
No job	29 (3.1)	9 (1.5)	38 (2.4)
Specialized manual jobs	584 (61.5)	485 (80.3)	1069 (68.8)
Specialized non-manual jobs	316 (33.3)	107 (17.7)	423 (27.2)
Managerial jobs	21 (2.2)	3 (0.5)	24 (1.5)

Table 2. The percent of the true responses to knowledge questions according to living in urban and rural region
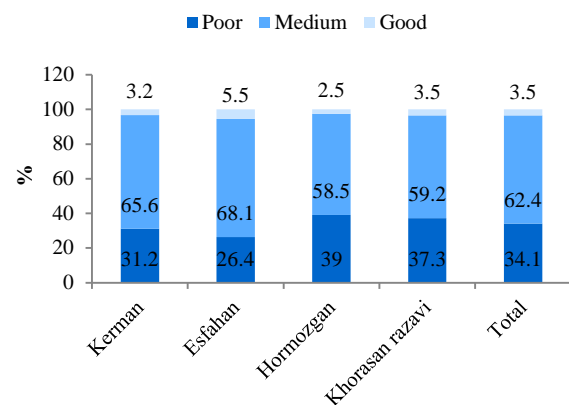
Knowledge questions	True (% total)	True (% urban)	True (% rural)	P
Do you think that drinking fruit juice will prevent tooth decay?	73.4	78.6	70.0	< 0.001
Do you think that eating mint candies and pastilles will prevent tooth decay?	69.8	73.8	63.6	< 0.001
Do you know which one of the following foods can cause tooth decay?	86.0	87.6	83.4	0.220
Cookie, chocolate, biscuit, cake, potato chips, and wafers				
Fresh fruits, raw vegetables				
I do not know				

The percentages of true answers to knowledge questions are shown in table 2. Urban students were significantly more knowledgeable about the impact of fruit juice and mint candies and pastilles on dental caries (Table 2).

The mean score of HDP was 17.5 ± 5.9 (from 40). Approximately 27.3% of students ate sugary foods (chocolate/cake/biscuit/chips), and 43.0% of them drank soft drinks (sugared tea or coffee or milked/soda/syrup) two or more times a day. However, the habit of eating fresh fruits and raw vegetables was stated by 15.0% of subjects two or more times a day (Figure 1). Seventeen percent of students consumed fresh fruits and raw vegetables once a day.

Figure 2. The level of diet related behavior of students in rural areas in different provinces

HDP scores in urban areas in various provinces were significantly lower than those in Tehran, the capital of Iran. Students residing in villages in Khorasan province had significantly lower mean score of HDP than other rural areas. Girls and boys had similar scores in HDP (17.4 ± 6.1 versus 17.5 ± 5.6, P = 0.740).
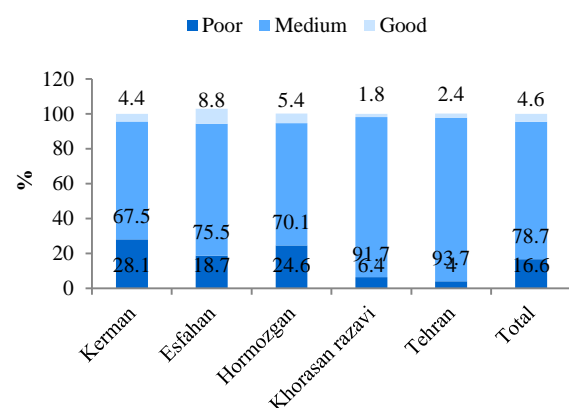

Figure 1. The percentage of students who used different snacks several times a day

Generally, students who were living in urban areas had higher scores in HDP (18.3 ± 5.4 vs. 16.1 ± 6.4, P < 0.001). The levels of HDP in urban and rural areas in different provinces are shown in figure 2 and 3.

Figure 3. The level of diet related behavior of students in urban areas in different provinces

Table 3. Prediction of the diet practice score in the multivariate regression model

Variables in diet practice	Mean ± SD	Coefficient regression (B)[*]	P
Province (urban areas)			
Tehran[**]	47.8 ± 8.3		
Kerman	43.0 ± 15.1	-5.1	< 0.001
Esfahan	47.3 ± 14.4	-0.5	0.700
Hormozgan	44.1 ± 16.6	-4.6	0.001
Khorasan	46.7 ± 11.0	-1.5	0.500
Province (rural areas)			
Esfahan[***]	42.5 ± 14.4		
Kerman	41.1 ± 14.0	-2.1	0.300
Hormozgan	38.1 ± 13.9	-5.2	0.020
Khorasan	37.5 ± 17.8	-5.5	0.006
Location			
Urban	45.7 ± 13.5	4.4	< 0.001
Rural	40.3 ± 16.0		
Sex			
Boy	43.7 ± 14.1	0.05	0.900
Girl	43.5 ± 15.3		
Mother education			
12 classes or more	45.6 ± 13.2	2.2	0.012
< 12 classes	41.3 ± 16.0		
Father education			
12 classes or more	45.2 ± 13.5	1.1	0.270
< 12 classes	41.3 ± 16.0		
Mother job			
Employers	45.3 ± 13.0	1.5	0.030
Housekeeping	42.8 ± 15.4		
Father job			
Specialized manual jobs	45.2 ± 14.4	0.5	0.500
Specialized non manual and managerial jobs	42.9 ± 15.0		

SD: Standard deviation

[*]Adjusted for other variables included in the table; [**]Tehran is reference for urban areas. (The negative sign of regression coefficient showed that the average scores in Esfahan, Kerman, Hormozgan, and Khorasan were lower than Tehran); [***]Esfahan for rural areas is reference. (The negative sign of regression coefficient showed that the average scores in Kerman, Hormozgan, and Khorasan were lower than Isfahan).

The results of multivariate regression analysis have been shown in table 3. In this model, HDP was inserted as dependent variable and sex, province and urbanization, parents' education and parents' job were considered as predictor variables. The most important factors were urbanization, province of residence, mothers' education and job. The results indicated that the average score for students in urban areas was 4.4 units higher than students in rural areas, and the difference was statistically significant [regression coefficients (β) = 4.4, P < 0.001]. The average score of children whose mothers had higher education (12 classes or more) was 2.2 units higher than students whose mothers had lower education (< 12 class)

(β = 2.2, P = 0.012). Students whose mothers were employed had scores significantly higher than the average (1.5 units), in comparison with housewives (β = 1.5, P = 0.030). In addition, the regression coefficients showed that the average scores in urban areas in Tehran, and in rural areas in Esfahan were higher than other areas. There was no significant correlation between fathers' job and education with diet behavior of students.

Discussion

The purpose of this research was to evaluate of the dietary patterns of 12-year-old children in Iran, which would aid the planning of oral health improvement programs. In the our

study, although it was shown that awareness of the students about the impact of too much sweets or soft drinks was high (86.0%), 43.0% of children had drank sweetened drinks (sweet tea or coffee/soda/syrups) and 27.3% had consumed some kind of sweet foods (chocolates/cakes/biscuits) two or more times a day during the previous week. This is higher than the outcome of an investigation in India, where 12.8% of the students with 10-19 years of age consumed sweet snacks one time a day.[15] Our finding is nearly identical to the results of two studies among 12-year-old schoolchildren from Iraq[2] and Albania[16]. In Iraq, 29.0% of children had consumed sweet snacks (chocolate/ice-cream/toffee) and 31.9% had consumed soft drink (sugared tea or milk) most frequently, more than once a day.[2] In Albania, 45.2% had consumed sweets and 26.6% had drunk soft drinks twice or more than twice a day.[16] The results of a study in India showed that consumption of cariogenic foods had no significant difference between students with good knowledge and poor knowledge that was similar to our findings, showing that diet behaviors are not fully explained by knowledge. In mentioned study, 24.5% of 12-year-old children had consumed a kind of sweet food (biscuits/jam/sweets) and 6.9% of students had drunk soft drinks more than 4 times a day.[17] Therefore, according to our study and the above-mentioned studies, it appears that consumption of cariogenic foods in developing countries is high.

Some epidemiological studies have indicated that fresh fruits and raw vegetables are non-cariogenic, and there is limited evidence to demonstrate fruit as a major factor in the development of dental caries. According to these studies, patients may be advised to eat more starchy main dishes and vegetables and whole fruit to replace sugary foods.[18] Therefore, although dried fruits may potentially be cariogenic, fresh fruits have not been associated with dental caries.[6] In addition, raw vegetables can lead to a boost in salivary flow and likely a decline in dental

caries.[4] In our study, consumption of fresh fruits and raw vegetables was low. The habit of eating these foods was reported by 15% of students, multiple times a day, and by 17% once a day. In most studies on the oral health behavior in children, diet questions were about consumption of cariogenic foods, and there were no questions about consumption of non-cariogenic foods. Only researchers in both studies asked questions about consumption of fresh fruit. In a study conducted in India,[19] it was shown that 40.8% of 12-year-old children consumed fresh fruits at least once a day, which is high in comparison with our study (32.0%). In another study in Burkina Faso,[20] consumption of fresh fruit at least once a day was 36.0% which was similar to our study.

Although dietary habits among children who lived in urban areas, children whose mothers were employed, and students whose mothers had higher education were significantly better, the amount of consumption of cariogenic foods among all the subjects was high. This could be owing to the lack of educational programs about the effect of diet (form, frequency and composition of food) on dental caries. Therefore, this is a strategy for professionals in the field of health to determine the diet-related caries and health-risk behaviors of population, and to promote oral health of children by planning educational programs for students, teachers and parents. Oral health education should include dietary and nutritional advice on oral health. Individuals should be recommended: 1. to decrease the frequency of intake of sweet foods; 2. to have balanced diets including a variety of foods (grains, fruits, and vegetables); 3. To combine dairy products (cheese), with fermentable carbohydrates and other sugars, add raw fruits or vegetables to the meals to boost the flow of saliva; 4. To limit consumption of sugary and acidic beverages; and 5. To chew sugar-free gums between meals and snacks.[6,21,22]

Anyway, this research might have had

certain limitations. In the present study, the information on diet practice was gathered by a questionnaire, and might be subjected to biased. It is possible that students have overestimated positive behaviors that are socially desirable answers, such as consumption of non-cariogenic foods and underestimated negative practices, such as consumption of cariogenic foods. Therefore, some over reporting would be considered likely with respect to the answers on behaviors towards healthy practice. Furthermore, recall bias must be taken into account that probably occurs in association with diet history and the students may have forgotten the exact number of foods. Furthermore, we cannot generalize the findings of this cross-sectional study, because oral health-related behaviors, in addition to knowledge and attitudes, are related to various factors like the socio-economic status, habits, and lifestyle. However, according to our research, it appears that consumption of cariogenic foods among 12-year-old children in Iran is high. And the study gives a possible association of the existing diet behaviors in the study population with the study variables.

Therefore, there is a need for further studies in the future. These studies should be designed to upgrade oral health behaviors and to find the most effective method of oral health education which changes individual behavior and sustains it for a longer period.

Conclusion

The results of our research indicated that dietary patterns were not satisfactory, and despite the relatively good knowledge, the amount of consumption of cariogenic foods was high. Therefore, we recommend designing school-based oral health educational programs with emphasis on the role of diet on dental caries that can have satisfactory effects on promotion of oral health due to effective networking within the schools.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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