Social Factors and Dental Health in the Urban Adolescents of Isfahan, Iran

Imaneh Asgari[1], **Arezoo Ebn Ahmady**[2]

[1]DDS, PhD of Public Oral Health, Assistant Professor, Department of Oral Public Health, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran. [2]MSc, PhD of Health Care Management, Associate Professor, Department of Community Oral Health, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Abstract

Aim: The aim of this study is to determine the dental caries and oral health behavior status of urban adolescents in Iran. Also it assesses the influence of the socioeconomic background on their oral health outcomes.

Methods: A cross-sectional study was conducted in the students living in the city of Isfahan, Iran. 597 adolescents by 13 to 17 years old participated in the study. The asset-based wealth index, household income and parents' educational history were the indicators of socioeconomic status. Data on tooth brushing frequency and smoking experience were collected, and the adolescents were examined for their dental health status. The index of DMFT was recorded by two calibrated examiners considering the criteria of World Health Organization. Bivariate analysis and multivariate regressions were employed to explore the association between dental caries status and socioeconomic variables.

Results: The DMFT mean (SD) of the study population was 2.79(2.7) with attributable 50, 4 and 46 percent to D, M and F components and 26% caries- free prevalence. Nearly 19% of the students presented twice daily brushing and 3% of respondents had smoking experience. Dental caries did not show any linear relationship with the social indicators when the DMFT was modeled by the wealth index, parents' educational level and family income adjusted for age and gender. Without adjustment, lower income has increased the chance of untreated tooth decay, 2.5 times among the students.

Conclusion: Despite the supporting findings on inequalities in oral health, this study did not show a direct association between socio economic backgrounds of the adolescents with their dental health/disease. The hypothesized balanced risk exposure is considered to justify the results, but it needs to be studied by further comprehensive analysis.

Key Words: Dental caries, Socio-economic status, Adolescents, DMFT index

Introduction

Public health interventions designed for oral health promotion should be evidence-based, and the survey should lead in a practical gain or could be translated from knowledge to practice. While general improvements have been occurred in children's oral health in some countries over the past few decades, oral disease particularly tooth decay remains a public health problem in Iran, yet. According to the oral health country profile published by World Health Organization oral health program, dental caries index of 12-years-olds have decreased from 4 to 1.5 during 1989 and 1999, but it has taken a steady line ever since [1,2]. Given the pathfinder national survey in 2004, 60 percent of 12-year-olds has experienced dental caries and they had a mean DMFT of 1.91 [1]. A recent local study in the city of Isfahan presented the index value of 4.8 for 12-19 years-old schoolchildren [3] and a steep rise in the caries index from early to late adolescence.

The factors leading to development of oral disease in children are likely to have their roots in a complex chain of social and environmental factors. Such variables like social class, education, employment, income, urbanization and gender in each cultural context may result in various exposures to risks of oral problems [4]. As for general health, social inequality in oral health appears to be a key public health problem, even in countries with a long tradition of oral health promotion systems [5-7].

In order to reduce inequalities, oral health promotion initiatives should be linked with the broader national public health programs [7]. Given the children and adolescents, the wide distribution of the schools all over the country make it available to reach a large group of people, efficiently and evenly so health-promoting school is of the most encouraging setting [4]. However, prior to the development of an oral health promotion effort, we have to evaluate the needs, resources and conditions for an appropriate decision. So, this study was conducted to provide a situational analysis for planning an oral health promotion program through healthy schools with the special focus on the social determinants of oral health in the age period of adolescence.

Regarding the identification of social classes, three practical approaches i.e. reputational, self-location and objective methods have been suggested [8]. In the adults, Socio-Economic Status (SES) is usually measured by income, education or occupation, but this kind of measurement is difficult in adolescents, both conceptually and methodologically. Conceptually, it is unclear whether parental SES could be used as a proxy for adolescents, and if so, which aspect is most relevant to them. Methodologically, it is not such easy to obtain the family information from adolescents because they do not know or are not willing to reveal it, which may result in high levels of missing data [9]. Since there is a lack of job classification system in most of the developing countries like Iran, income and occupation information is not accessible and reliable. In such settings, other methods of measuring SES are being used to gather the variables required to capture living standards, such as household ownership of durable assets, infrastructure, housing characteristics, the source of water and sanitation facility. The issue of aggregation all the variables to

Corresponding author: Dr. Imaneh Asgari, DDS, PhD, Assistant professor, Department of Oral Public Health, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran; Tel: +989133108374, +983117922894; e-mail: asgari_i@dnt.mui.ac.ir, asgari_i@yahoo.com

driving a unique measure of SES resulted in the application of some weighting methods applied in the recent research [10,11].

Recently epidemiological research on health has relied greatly on the subjective dimensions of SES, too. Self-reported measure of SES proved to be a strong determinant of adolescents' psychosomatic symptoms, self-perceived health and psychological well-being. Subjective social status which refers to "the individual's perception of his own position in the social hierarchy" [12] has just been used to explore health inequalities [12-15]. Regarding the oral health as a social concept rather than a term of biological criteria, this indicator might be also a predictor for dental health status [16].

Aim

Therefore, the main goal of the present study is to determine the dental caries and oral health behavior in a sample of urban Iranian adolescents enrolling the public schools with substantial focus on their socioeconomic backgrounds.

Methods

Sampling

Ethical approval was obtained from the Human Research Ethics Committee of the Isfahan University of Medical Sciences and the Isfahan Bureau of Education. The study frame was the adolescents aged 13 to 17 enrolled in public middle and high schools in the city of Isfahan, Iran. Non-proportional, two-stage stratified random sampling was used to select the representative sample of the population. Strata were the regions of the local education authority which seemed to be as an indicator of socio-economic distribution. Considering the effect size of 0.05 (small to medium), 90% power and five predictors at the level of 95% significance, sample size of 334 was calculated. As there was a likely high prevalence in the missing data, 30% drop-out rate estimated and minimally a sample size of 435 was gained. Twenty schools (boys and girls) and then thirty students from each school were randomly selected from the list of schools and invited to take part in the study. An informed consent letter was given to the parents. Subjects were free to refuse each part of the study.

The adolescents answered the questions about socio-demographic backgrounds at the classroom, with the supervision of their teacher, and then participated in a clinical oral examination.

The subjective SES indicator

The Subjective SES (SSES) indicator was asked using a graphical representation of a ladder with 10 rungs accompanied by the following question: "Think of this ladder as representing where people stand in our society; how you would rate your family's socio economic status?" They asked to mark a cross on the rung on the ladder where they placed themselves. The answer was considered as a numerical variable.

The objective SES indicator

Socioeconomic status was assessed by parents' education, family income and family wealth. The family wealth index was constructed on asset basis through three steps: selection the asset variables, application of exploratory factor analysis on the variables to reach the factors and factor loadings and classification of households into categories. A short set of variables was selected from the list of the variables used in the other studies. Because almost all the households had similar access to utilities and infrastructure like sanitation facility and source of water in the city, they had low standard deviation and did not worth to consider. The ownership of private car, computer or laptop, washing machine, LCD television, personal bedroom at home and kind of housing (living in a rented or owner-occupied house) were chosen as dichotomous variables. After collecting the data, descriptive analysis was carried out on all variables and the participants with high missing values (n=27, 4.5%) were excluded from the analysis. To reach the appropriate weight for each item, we run an exploratory factor analysis with Principal Components Analysis (PCA) method to the set of variables. The wealth index consists of the first principal component, since it summarizes the largest amount of information common to the wealth. The Eigen value (variance) for each component indicates the percentage of variation in the total data explained [11]. Using the factor loadings as weights, a dependent variable constructed for the household wealth. The constructed wealth index could be included as a continuous independent variable in a regression model, but since the estimated coefficient may not be easy to interpret [11], division of household into quintiles is a commonly used method to categorize them. The household were classified into tertiles as low, middle and high wealth status because of the low number of variables contributed in the present study. Parent's level of education and household income were collected as categorical variables, too. The income level of family was asked as a four categorical scale. An option for who do not know or do not tend to say was considered. Educational level of the student's father and mother was scored in a five-grade range from illiterate to more than twelve school years [17-19].

Oral health outcomes

Dental caries experience was determined according to the WHO criteria of basic methods of surveys. Two qualified dentists (PI and her assistant), who were trained and calibrated to achieve desirable agreement in the pilot study prior to the project, were recorded Decayed, Missing and Filled Teeth (DMFT) index of the adolescents. Examinations were carried out under natural and artificial room light in the schools. A disposable plane mouth mirror and WHO periodontal probe were also used for examination, and teeth were dried with dental gauze or cotton roll before examination. The teeth 8 were not included in the study and the subjects with premolar missing were questioned for history of orthodontic treatment.

Frequency of tooth brushing was scored as twice a day and more, once a day and less than once a day. Self-rated oral health was measured with the following statement "Would you say your oral health is excellent/very good/good/fair/poor". Also, they were asked about their perceived dental treatment need that was answered on a five-point Likert scale from "strongly disagree to strongly agree."

Statistical analysis

All data were analyzed by the SPSS 16.0 system for Windows. While descriptive analysis was carried out on the data, differences in variables frequencies were tested using the Chi-square test. The relation between numerical (DMFT, SSES) variables was analyzed by Spearman bivariate correlation

test. The wealth index was developed by the PCA method of exploratory factor analysis. The Eigen values greater than one and absolute factor loadings greater than 0.40 was considered for extracting the latent variable. Using Mann-Witney U and Kruskal-Wallis nonparametric tests, the differences between mean DMFT and its components and the need to care (D/DMFT*100) were tested in relation to the independent factors. DMFT was modelled by multiple linear regression with enter method. Logistic regression analysis was applied to study three binary variables on dental caries status (dependent variables) with demographic and social variables (independent variables).

Results

Descriptive analysis

Clinical data was collected from 592 adolescents of the sample (response rate 99%). The mean (SD) age of the sample was 14.9 (1.2), which 52.8% were female. The prevalence of caries experience was 74 percent and 57% of the students had at least one untreated decayed tooth in their mouth. The mean (SD) of DMFT was 2.53 (2.5) in 13-15 years old and 3.29 (3.1) in 15 -17 years old students. *Figure 1* shows the caries experience in different age groups.

Nearly half of the examined children had moderate caries experience (DMFT: 1 to 4), while the prevalence of high (DMFT: 4 to 7) and severe (DMFT>7) caries were 15.5 and 6.3 percent, respectively. The components of DT, MT and FT comprised 50, 4 and 46 percent of the total index. *Table 1* summarized the dental caries status of the study population.

Dental caries index did not distribute normally (skewness: 1.1, kurtosis: 1.2) and Significant caries index (SiC) was 5.8 (2.1). Regards the student's self-perceptions about oral health, 291(49 %) felt some need to dental treatment and 369 (62.7%) evaluated their oral health as excellent to good.

More than fifty percent of the respondent (3% missing) said to have the habit of once a day brushing, while 19.3 and 27.5% presented twice a day and less than one time brushing, respectively.

The relationship between subjective SES and dental caries

The bivariate correlation analysis showed a medium significant correlation (r=0.54, p<0.001) between the SES indicator and SSES. Untreated decayed teeth (DT) showed a weak reverse correlation with SSES (r=-0.1, p=0.02). Moreover, the persons with better SSES represented better self-perceived oral health and less dental treatment need and better self-care habits, but this was a weak relationship, (r=0.1,p<0.05).

Socio- demographic distribution of dental health

The response rate at the questions about parents' education was 98 percent. But it was about 95% and 67% in case of assets and family income, respectively. Oral health outcomes included dental caries experience and need to dental care were compared by unadjusted analysis in social and demographic categories assumed that have relation **(***Table 2***).** Dental care need was significantly higher in boys than girls (p<0.001). Except the age by a predictable relation with dental caries, all other variables did not meet the hypothesized relations in the sample (p>0.05). As it can be seen in the *Figure 2***,** dental caries did not follow a distinct pattern by increasing the educational level of the students' mothers.

Wealth index and dental health

Running the exploratory factor analysis, the measurement of sampling adequacy (Kaiser-Meyer-Olkin: 0.75) and significance level of Bartlett's test of Sphericity (p-value<0.001) indicated that there were probably significant relationships among items, and that the sample size were suitable for factor analysis. The first principal component as latent wealth variable, accounted for 35.9% of the variance in the possession of the assets. The crude SES index ranged from 0 to 3.5 and with cut points of 1.53 and 2.22, the sample was divided into tertiles. As it could be seen in the *Figure 3*, there is not significant differences in the mean dental caries regarding three wealth status (Kruskal-Wallis Test, p>0.05). Dental caries status did not show any linear relationship with the social indicators when the DMFT was modeling by the wealth index **(**β:-0.03**),** father's and mother's educational level (β:0.01,-0.09), age **(**β:0.2) and gender **(**β:-0.02) and the total R square was 0.05. When the analysis were replicated by the students who had the complete data on household income 364 (61%) the coefficient of determination had risen up a little, but it did not give any significant predicting model, too (R^2:0.07). Three outcomes as indicators of dental health status i.e. caries-free status, having DMFT>7 and having untreated decayed teeth were modeled in the binary logistic regression analysis. The results of adjusted odds ratio for the

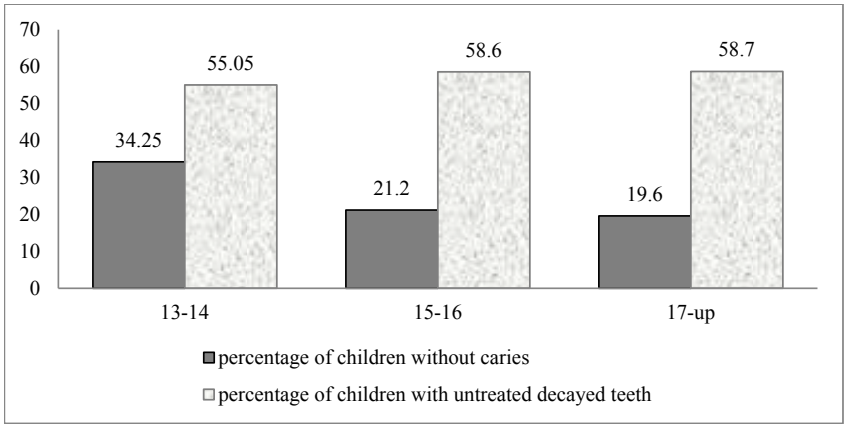

Figure 1*. The prevalence of caries-free students and untreated decayed teeth in the 13 to 17 years old sample of Iranian schoolchildren (n= 597).*

Table1*. Description of dental caries status in the sample of 13-17 Iranian adolescents.*

Dental health status (n=592)	*Mean (SD) DMFT*	*Mean (SD) DT*	*Mean (SD) MT*	*Mean (SD) FT*	*caries free percentage*
	2.79 (2.68)	1.39 (1.7)	0.13 (0.4)	1.29 (2.16)	26%

***Table 2**. The relation between socio-demographic variables and dental caries experience (DMFT) and percent of need to dental care (D/DMFT*100) in the sample.*

Variable	Category	Mean DMFT	p-value	D/DMFT% (n=438)	p-value
Age	13-15years (n=384)	2.53	0.003*	61	0.15
	15-18years (n=208)	2.26		53	
Gender	Male (n=281)	2.78	0.85	68	0.000*
	Female (n=311)	2.80		49	
Father's education level	Illiterate (n=40)	2.7	0.09	37	0.73
	<12 years (n=208)	3.14		41	
	12years (n=344)	2.6		66	
	>12years	2.6		40	
Mother's education level	Illiterate (n=43)	2.6	0.07	71	0.07
	<12 years (n=244)	3.1		55	
	12years (n=305)	2.8		53	
	>12years	1.9		61	
Family income	<10million Rials† /month (n=355)	2.84	0.5	61	0.16
	>10million Rials/month (n=37)	2.57		46	
	Do not know/unwilling to say (n=205)	2.4		54	
Geographic distribution	1	2.80	0.33	48	0.047*
	2	2.69		61	
	3	3.08		59	
	4	2.66		62	

*= significant differences at p<0.05

†= One million Iranian Rials equivalent to 81.3 US Dollars (1US$:12,300IRR)

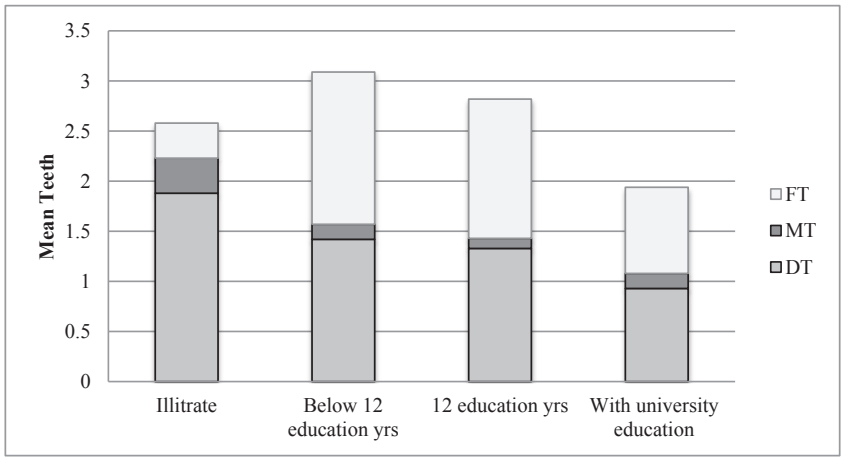

***Figure 2**. Mean DT (Decayed Teeth), MT (Missing Teeth), FT (Filled Teeth) and DMFT styles by levels of mother education in the sample of Iranian adolescents.*

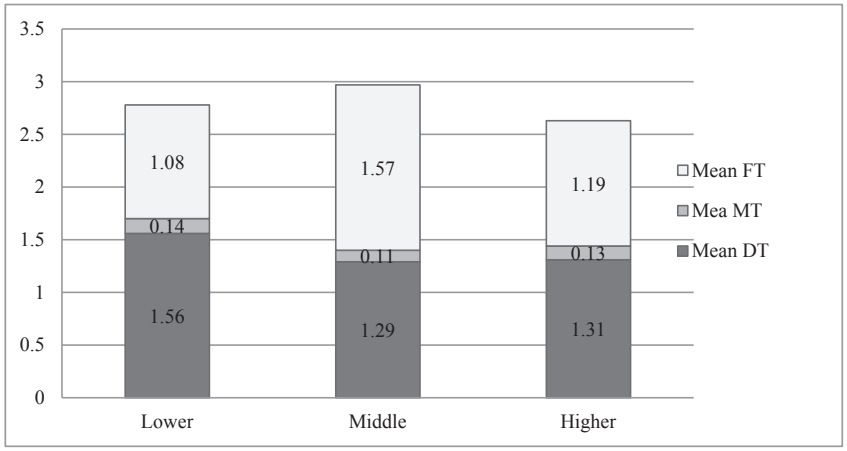

***Figure 3.** Mean decay, missing and filled teeth by lower to higher wealth index in the sample of Iranian adolescents.*

students without missing values on the independent variables demonstrated in the *Table 3*.

The students without caries did not follow any distinct model concerning the demographic, socio economic status and available health behavior. Only, tobacco use seemed to raise the probability of having severe dental condition or decayed tooth more than three times. As a sole factor, students, due to the lower income families, had untreated caries 2.5 times more than higher income counterpart (unadjusted odds ratio). The mean DT of this group was significantly more than the richer ones (p=0.04). None of the independent variables was shown as significant predictors of dichotomous caries status.

***Table 3**. Adjusted Odds Ratio and 95% confidence interval for caries-free status, having DMFT>7 and having untreated decayed teeth by socio-demographic independent variables (n=364).*

Variables	Category	Caries-free (DMFT=0)	Severe caries (DMFT>7)	Untreated tooth decay (DT≥1)
Socio-demographic		**Adjusted OR (95%CI)**	**Adjusted OR (95%CI)**	**Adjusted OR (95%CI)**
Gender	Male (203)	1	0.67 (0.3-1.7)	1.65 (1.1-2.6)*
	Female (161)	1.1 (0.7-1.9)	1	1
Age group	Early adolescence (239)	1	0.4 (0.2-0.8)*	1
	Late adolescence (125)	0.6 (0.4-1.1)	1	0.89 (0.57-1.4)
Wealth index	Lower (111)	1	1.6 (0.7-3.8)	1
	Middle (140)	1.04 (0.5-1.9)	1.2 (0.5-3.3)	1.1 (0.6-1.9)
	Higher (113)	1.08 (0.6-1.9)	1	0.8 (0.53-1.5)
Household income level	Above 10million IRRials/month (33)	1.8 (0.8-4.1)	1	1
	Below 10million IRRials/month[§] (331)	1	1.9 (0.4-8.9)	1.8 (0.9-3.9)[+]
Father education qualification	With university degrees (65)	1	0.67 (0.3-1.7)	1.01 (0.5-1.9)
	Without university degrees (299)	1.05 (0.5-2.1)	1	1
mother education qualification	With university degrees (35)	1	1	0.86 (0.4-1.9)
	Without university degrees (329)	0.85 (0.4-2)	4.5 (0.6-35)[+]	1
Health-related behaviors				
Tooth brushing frequency	≥ twice a day (68)	1.3 (0.6-2.7)	1	1
	once a day (189)	0.95 (0.5-1.6)	1.2 (0.5-2.9)	0.86 (0.45-1.65)
	< once a day (107)	1	1.8 (0.7-5.1)	0.83 (0.5-1.4)
Smoking experience	Positive (14)	1	1	3.7 (1.1-12)*
	negative (350)	2.2 (0.7-6.7)	0.3 (0.08-1)*	1

*= significant at the level of 0.05, [+]Significant unadjusted OR ($p<0.005$ with qui^2 test)
[§]= One million Iranian Rials (IRR) equivalent to 81.3 US Dollars (1US$:12,300 IRR)

The socioeconomic status and oral self-care

Tooth brushing habits had significant differences between the students from various wealth status. As, it could be seen in *Table 4*, the better oral self-care is more prevalent in more affluent families as 43 percent of the students without tooth cleaning habits were growing in the lower class of society. Logistic regression of the binary variable for brushing the teeth at least once a day indicated that students- who were in middle wealth status (OR:1.8, p=0.02), had mothers with university qualifications (OR:2.5, p=0.02) and girls (OR:3.6, p<0.001) had higher chance of good oral habits.

Discussion

Exploring the social disparities in the adolescents revealed that there were not any significant differences in the mean dental caries indices regarding the educational level of the parents, household income, and wealth status in this study sample.

It is well documented that despite the improvements in oral health in several countries, inequalities in oral health exists and tend to widening between and within countries. Social, economic and political environments are the upstream drivers of these inequities which represented in different oral health outcomes and consequences [7]. Educational level, household wealth and place of residence had significant differences for most oral health outcomes and oral health behaviors investigated in the Tanzanian adolescents [19]. Preschool children with low socioeconomic status were more likely to have dental caries in the Bangkok [20]. Higher economic status, more educated mothers and mothers received information about caries prevention were more probable to visit dentists routinely [21]. Sanders found that three dimensions of perceived oral health including impacts of oral problems, self-rated oral health and reported tooth loss demonstrated significant inequality in dentate adults in Australia [22]. In the adolescents of Pennsylvania, SES disparities were observed in the prevalence of caries experience, a measure of severe caries, tooth brushing, sealant use, and dental utilization [23].

Despite of the hypothesized inequality of oral health status in our population, the results showed a surprising equivalent condition in students with different backgrounds. As there are some evidences of equalization during adolescence and young adulthood in the other health outcomes, it might be explained by school factors, formation a special autonomous, reliance on the peers in the socialization process and relatively rare morbidity and mortality during this period [13].

From one point of view the equality of dental health status in the present population may be a consequence of potential selection bias and information bias in the study. The first limitation of the study seems to be ignoring the rural and suburban districts in the sampling frame. Because we assumed that there was a diverse distribution of social and economic groups in the urban part of the province, the sampling process was taken part on the base of geographical divisions, just within the city. The next problem probably comes from disregarding the private schools students in the sampling. Although the public schools would be referred by all groups of population, there may be definite social characteristics of the families which lead to selection either the public or private schools. Such presumed factors like higher affluence, education levels, attention to children and priorities in life need to be further studied. Regarding the information bias, there is no doubt about the data collection process as the clinical data seemed to be gathered at the best

***Table 4**. Distribution of adolescents with different oral self-care habits in relation to their household SES groups (percent in the wealth category), n=560.*

Tooth brushing frequency	Wealth status			Total	P-value
	Low	Middle	High		
Twice a day	25 (13.4%)	42 (22.1%)	42 (23%)	109 (19.5%)	0.01*
Once a day	96 (51.3%)	101 (53.2%)	100 (54.6%)	297 (53%)	
Below once a day	66 (35.3%)	47 (24.7%)	41 (20.4%)	154 (27.5%)	
Total	187	190	183	560	

available validity. In addition to training and calibration of examiners prior to the main study, the principal investigator had presented at all sites and done the final decision on the borderline lesions. Absolutely it may be unreliable to ask from the children about the social variables and it is better to ask the parents about the details of housing and expenditure such as the study of Polk and colleagues [23] but, due to our social culture, we could not ask them to divulge their privacy. So, the application of three indicators i.e. asset-based wealth, income and education were the method used to tackle with the mentioned situation.

What could be the cause of such equity seen in the urban public school students is "balanced total exposure to risk factors". As we are in the transition stage in our population, the negative and positive risk factors of dental caries have such complex interactions that may result in a fairly same unfavorable outcome. It would be clearer with a real example; the dietary habit of sugary food consumption has been a custom in our community. Such snacks and beverage are available at the schools. It is available for all children especially the teenagers which tend to eat out of home more. The more educated parents advice their children about the risks to the teeth and insist on tooth brushing. While, less affluent families with likely less information about the cause of dental caries and prevention, give limited pocket money to their children and use mother-made snacks more. This caused the balanced risk factors.

The trend of caries progression seems to be relatively fast, in current population. The mean DMFT of the examined children increased from 1.9 for thirteens to 3.7 in seventeens while the students without caries fallen down from 35% to 19% in the attributable age. Although, we have explored some distal drivers of the dental caries in this study, it remains unclear through which pathways the determinants lead to caries experience. Moreover, the studied proximal risk factor i.e. tooth brushing which was related to wealth, mother's education and gender, did not show any role in the occurrence or severity of dental caries.

Learning from the other countries, it seems inevitable to encounter inequality if not in the adolescents but in the adults and elderly. So we should plan for future oral health promotion without inequality. The concept of healthy promoting schools with availability of nutritious food, safe buildings and tobacco-free and stress-free environment should be overcome. If effective interactive oral health education integrated to health promotion programs and education curricula, all social classes would benefit from it. And the important key of access to care, both preventive and curative, could be implemented for the vulnerable groups via a school-based system. It should be considered the focus on only downstream factors will benefit the privileged social positions more than others and may expand the inequalities [7]. Regarding the limitation, further studies at the same setting with a purposive sampling and by the same criteria should be planned to draw the pathway model of distal and proximal determinants running the oral health status of the adolescents. Identifying these pathways is important in creating an effective oral health promotion program.

Conclusion

The main finding of this study is that the social disparities has not been involved the oral health situation of the Iranian adolescents yet. The authors suggested the "balanced total exposure to risk factors" hypothesis to explain observed result.

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