

# Dental health status and risk factors for dental caries in adults in Istanbul, Turkey

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أوضاع صحة الأسنان وعوامل اختطار الإصابة بالتسوس لدى البالغين في اسطنبول، بتركيا  
نجمي نامال، كوناى جان، صبحي وحيد، سلجوق كوكسال، عائشة قبيماز

**الخلاصة:** هدفت هذه الدراسة إلى تسجيل مظاهر صحة الفم لدى البالغين في اسطنبول، بتركيا، وتقييم مؤشرات الاختطار المرتبطة بمُنسَب تسوس الأسنان المُعتدُّ به جداً من الناحية الإحصائية. وقد دعي 2183 شخصاً في منطقة بَيْرَم باشا، تراوحت أعمارهم بين 18 و 74 عاماً، ومثّلوا عينة عشوائية، لإجراء فحص مجاني للأسنان، وإجراء مقابلة معهم. وكان متوسط مُنسَب الأسنان sic المنخورة والمفقودة والمحشوة DMFT 11.44، ومُنسَب تسوس الأسنان 14.00، متزايداً من 6.00 في الفئة العمرية 18 – 19 عاماً، إلى 15.32 في الفئة العمرية 33 – 44 عاماً ثم إلى 28.00 في الفئة العمرية 65 – 74 عاماً. وأوضح تحليل التَحَوُّف اللوجستي أن مؤشرات الاختطار التي يُعتدُّ بها جداً تشمل التقدم في العمر، والجنس المؤنث، وكون المرء مولوداً في الريف.

**ABSTRACT** The aim this study was to record the oral health in adults in Istanbul, Turkey, and to evaluate the risk indicators associated with a high significant caries index (SiC). A random sample of 2183 individuals in Bayrampasa district aged between 18 and 74 years were invited for a free dental examination and interview. The mean decayed, missing and filled teeth index (DMFT) was 11.44 and the SiC was 14.00, increasing from 6.00 for the age group 18–19 years to 15.32 at 33–44 years and 28.00 at 65–74 years. Logistic regression analysis showed that older age, female sex and rural origin of birth were the significant risk indicators for a high SiC index.

## Santé bucco-dentaire et facteurs de risque carieux chez l'adulte à Istanbul en Turquie

**RÉSUMÉ** Cette étude avait pour objectifs de dresser le constat de la santé bucco-dentaire de l'adulte à Istanbul en Turquie et d'évaluer les indicateurs de risque associés à un indice significatif de caries (SiC, pour *Significant Caries index*) élevé. Un échantillon aléatoire de 2183 habitants du district de Bayrampasa, âgés de 18 à 74 ans, a été invité à se soumettre à un examen dentaire gratuit et à un questionnaire. On a enregistré un indice CAO moyen (CAO = dent cariée, absente ou obturée) de 11,44 et un indice SiC de 14,00, ce dernier partant de 6,00 pour la tranche d'âge 18-19 ans pour atteindre 15,32 pour la tranche 33-44 ans et 28,00 pour la tranche 65-74 ans. Selon l'analyse de régression logistique, l'avancée en âge, l'appartenance au sexe féminin et la naissance en zone rurale sont les indicateurs de risque significatifs associés à un indice SiC élevé.

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## Introduction

Epidemiological studies of dental caries in adults are relatively rare. However, during the last decade studies have indicated that caries comprise a major problem in the adult population of both developing and industrialized countries [1,2].

Risk indicators of dental caries among adults have been evaluated by different investigators in different parts of the world, with age being the most commonly reported factor associated with a higher number of dental caries [3,4]. Women were reported in some articles to have more dental caries than men [5,6], while another study did not show any significant differences between men and women [7]. Income and education have always been reported to be associated with dental caries [8–10]. In Italy, the level of education was negatively associated with dental caries when age was constant [9]. In Turkey, dental caries values were weakly correlated with the level of education and income [10]. In China, individuals who were economically less well off had higher dental caries scores [6]. Poor oral hygiene practices also lead to increased dental caries [11]. Other reported factors associated with the dental caries include location (urban or rural), sociobehavioural factors and diet [10–12].

At the World Health Assembly in 1982 the World Health Organization (WHO) defined the acceptable dental health level in terms of average decayed, missing and filled teeth index (DMFT) for adults in different age groups. These were: 4 DMFT at age 18 years, 6 DMFT for age 35–44 years and 12 DMFT for age 65+ years [13].

In Turkey, the only source of data at the national level is a situation analysis of oral health in Turkey, which was made in 1990 [14]. According to the study, the average DMFT value was 4.14 for the 15–19 age

group, which is similar to WHO's. However, DMFT was 11.59 for the 35–44 age group, which is twice the WHO value, and 28.76 at 65+ years DMFT, which is more than twice the accepted value [14].

Turkey (with 70 million population) can be accepted a bridge between Europe and the Eastern Mediterranean Region. Istanbul is the largest city in Turkey. The current study evaluated the prevalence of dental caries in a random sample of Istanbul adults aged 18–74 years. It also aimed to identify the sociodemographic characteristics associated with a high carries index to determine which individuals are most at risk.

## Methods

This cross-sectional study was conducted using a sample of people randomly selected in the Bayrampasa district of Istanbul. The district was chosen for this research as its sociodemographic characteristics are close to the average values for Istanbul [15]. A total of 2183 people aged 18 to 74 years were examined between December 2001 and December 2002. Prior to the study, a local announcement was made by the authorities that a free dental examination would be performed on the local inhabitants of the region.

Information was collected about socio-demographic characteristics and oral hygiene practices by face-to-face interviews. Data were collected on age, sex, marital status, birth place (rural or urban), number of years of education, occupation, number of children and frequency of toothbrushing. A standard occupational classification system was adapted to the local situation and individuals were classified into 3 socio-economic groups: worker (skilled worker, e.g. professionals and managerial officers and retirees of this type); self-employed:

(unskilled workers e.g. artisans and traders); and dependant (housewives of self-employed) [16]. The individuals who brushed their teeth at least once a day were classified as regular brushers and those brushing less than once a day were classified as irregular brushers.

Every subject was examined by a single examiner who used a plain mirror and ballpoint probe, under standard light with air drying when necessary. No radiographs were taken. Ethical approval for this study was obtained from the Ethics Committee of the Cerrahpasa Medical School of the University of Istanbul and informed consent was obtained from all the participants. Carious defects, fillings and missing teeth were diagnosed and the DMFT(teeth) and DMFS(surfaces) scores were calculated according to WHO guidelines [17]. The significant caries index (SiC) was calculated as the mean DMFT for the one-third of the population with the highest caries scores [18,19]. The mean SiC value of the study group was 14.00 (DMFT). Individuals having the positive SiC values (i.e.  $\geq 14.00$

DMFT) were coded 1 while individuals with negative SiC values ( $< 14.00$  DMFT) were coded 0.

The data were transferred to a computer and the chi-squared test was used to determine the relationship of SiC index with the various sociodemographic factors and frequency of toothbrushing. Logistic regression was utilized to develop a risk assessment model for the significant factors obtained from the chi-squared test. The *P*-values for entry and exit from the model were 0.05 and 0.10 respectively.

## Results

The study group was 2183 Turkish adults. The mean age of the participants was 39.41 and age range was 18–74 years. Females accounted for 60.5% ( $n = 1321$ ) and males for 39.5% ( $n = 862$ ). The mean length of education was 5.2 years.

Table 1 shows the DMFT and SiC index values by age group. The mean SiC index of the study group was 14.00 and it increased

**Table 1 Percentage distribution of components of decayed, missing and filled teeth index (DMFT) and significant caries index (SiC) values by age group**

Age (years)	No. examined	D teeth Mean	M teeth Mean	F teeth Mean	DMFT index Mean (SD)	SiC index
18–19	153	3.23	0.88	0.86	4.96 (3.16)	6.00
20–24	309	2.63	1.48	1.59	5.70 (3.63)	7.00
25–29	331	2.69	2.65	2.25	7.56 (4.74)	9.00
30–34	265	2.38	4.71	2.87	9.96 (6.30)	12.00
35–44	595	1.43	7.89	3.40	12.62 (7.28)	15.32
45–54	337	0.97	13.51	2.90	17.36 (7.56)	22.00
55–64	127	0.46	16.80	2.38	19.60 (7.56)	25.00
65+	66	0.33	19.58	2.26	22.17 (6.71)	28.00
Total	2183	1.87	7.05	2.56	11.44 (7.87)	14.00

*SD = standard deviation.*

with age; the mean SiC was 6.00 at age 18–19 years, 15.32 at 33–44 years and 28.00 at 65–74 years. The distribution of the components of the DMFT index showed that the “M” (missing) score was the major component. The mean (SD) DMFT value for the study group was 11.44 (7.87) and this increased with age from 4.96 for age groups 18–19 years, to 12.62 for 35–44 years and 22.17 at 65–74 years.

Table 2 shows the DMFS and dental caries prevalence by age group. The prevalence of dental caries for the whole study group was 62.0% and this decreased with age from 85.0% at age 18–19 years, to 58.2% at 35–44 years and 16.7% at 65–74 years. The distribution of the components of the DMFS index showed that the “M” score for missing surfaces was again the major component of the DMFS index. The mean (SD) DMFS value of the study group was 45.71 (39.18), which again increased with age from 10.10 at age 18–19 years to 53.14 at 35–44 years and 102.73 at 65–74 years.

Table 3 shows the results of the chi-squared test comparing the group with

positive SiC with those with negative SiC according to age, sex, marital status, place of birth, education, occupation, number of children and frequency of toothbrushing. The overall percentage of participants with positive SiC was 34.4% and this increased with age. The percentage of females with positive SiC (38.7%) was significantly higher than males (28.0%) ( $P < 0.001$ ) (Table 3).

The rate of positive SiC was 6.4% for single people, significantly lower than that of married people (42.8%) ( $P < 0.001$ ). The percentage with positive SiC increased with the number of children ( $P < 0.001$ ). The percentage of people from a rural origin with positive SiC was 45.5%, higher than those of urban origin (21.9%) ( $P < 0.001$ ) (Table 3). The rate of positive SiC decreased with increased length of education ( $P < 0.001$ ) and also varied by occupation: 46.6% among dependents, 31.1% among workers and 25.0% among the self-employed ( $P < 0.001$ ).

A higher percentage with positive SiC was found among participants who brushed

Table 2 Percentage distribution of components of decayed, missing and filled surfaces index (DMFS) and caries prevalence (%) by age group

Age (years)	No. examined	DS teeth Mean	MS teeth Mean	FS teeth Mean	DMFS index Mean (SD)	Caries prevalence
18–19	153	4.44	4.08	1.58	10.10 (8.79)	85.0
20–24	309	3.69	7.31	3.36	14.36 (13.33)	78.3
25–29	331	4.34	12.82	6.75	23.91 (21.07)	77.3
30–34	265	3.84	23.51	9.80	37.15 (30.20)	74.3
35–44	595	2.48	37.40	13.26	53.14 (35.01)	58.2
45–54	337	1.81	62.99	12.59	77.39 (36.53)	41.5
55–64	127	0.98	78.42	10.06	89.46 (35.60)	25.2
65+	66	0.80	91.98	9.95	102.73 (27.97)	16.7
Total	2183	2.99	33.52	9.24	45.71 (39.18)	62.0

SD = standard deviation.

**Table 3 Percentage of people with positive significant caries index (SiC) values, by sociodemographic variables and toothbrushing**

Variable	No. examined	% <sup>a</sup>	Positive SiC %	$\chi^2$
<i>Total</i>	2183	100.0	34.4	
<i>Age (years)</i>				
18–24	462	21.2	2.8	622.46***
25–34	596	27.3	18.3	
35–44	595	27.3	41.5	
≥ 45	530	24.3	72.3	
<i>Sex</i>				
Male	862	39.5	28.0	26.57***
Female	1321	60.5	38.7	
<i>Marital status</i>				
Single	502	23.0	6.4	227.53***
Married	1681	77.0	42.8	
<i>Birth place</i>				
Urban	1022	46.8	21.9	133.61***
Rural	1161	53.2	45.5	
<i>Education</i>				
None	171	7.8	71.9	158.89***
1–10 years	1570	72.0	35.0	
11+ years	442	20.2	18.1	
<i>Occupation</i>				
Dependant	728	33.3	46.6	76.96***
Worker	807	37.0	31.1	
Self-employed	648	29.7	25.0	
<i>No. of children</i>				
0	688	31.5	12.9	289.16***
1–2	764	35.0	33.4	
≥ 3	731	33.5	55.8	
<i>Toothbrushing</i>				
Irregular	1073	49.2	41.2	42.51***
Regular	1110	50.8	27.9	

<sup>a</sup>Evaluations were made according to line totals.

\*\*\*P < 0.001.

their teeth irregularly (41.2%) and this was significantly higher than those who brushed regularly (27.9%) ( $P < 0.001$ ) (Table 3).

The logistic regression analysis shows that the significant risk factors for a positive SiC value were older age, female sex and rural birth place origin (Table 4).

## Discussion

The mean values of DMFT index by age group in the current study in 2002 were in accordance with the previous study in 1990 [14], with values that were similar at all age groups except the older group aged 65+

Table 4 Results of logistic regression analysis for significant caries index

Variable <sup>a</sup>	B	SE	Wald	P-value	Exp(B)	95% CI for exp(B)
<i>Age (years)</i>						
(18–24)			239.83	< 0.0001		
25–34	1.745	0.334	29.02	< 0.0001	5.73	3.04–10.81
35–44	2.771	0.330	70.67	< 0.0001	15.98	8.38–30.50
≥ 45	4.043	0.345	137.33	< 0.0001	56.98	29.00–112.03
<i>Sex</i>						
(Male)						
Female	0.603	0.159	14.41	< 0.0001	1.83	1.34–2.50
<i>Birth place</i>						
(Urban)						
Rural	0.342	0.117	8.54	0.003	1.41	1.12–1.77
Constant	–3.715	0.416	79.63	< 0.0001	0.02	

<sup>a</sup>Reference categories in parentheses.

SE = standard error; CI = confidence interval.

years where they were slightly lower (22.17 in this study versus 28.76). This similarity showed that there has been no change in the oral health of adults in Istanbul between 1990 and 2002.

The average DMFT index was 4.96 for ages 18–19 years in this study which is very close to the value accepted by WHO for 18-year-olds [13]. This DMFT value is similar to that for 18-year-olds reported by the United States (4.5), and was better than many developed countries, such as the Czech Republic (6.2), Belarus (6.8), Austria (5.5) and Norway (6.9), except for Singapore (2.7). It was worse than some developing countries, such as Tanzania (0.7), Ethiopia (2.0), Niger (2.5) and Indonesia (2.7) [20]. Our study showed caries prevalence of 85%, compared with 84% from Austria, 90% from Norway and 95.1% from Indonesia [20].

The mean DMFT value in this study was estimated as 12.62 for the 35–44 age group. This value was 2-fold worse than the WHO targets [13]. Our result, however, showed a better situation than

in many developed countries; DMFT for 35–44 years olds were 14.7 in Austria, 20.5 in Norway, 16.7 in Denmark, 16.6 in the United Kingdom, 16.1 in Germany and 20.0 in Canada [20]. Our figure was equal to the values of Morocco and Israel and worse than developing countries such as Fiji, Niger, Zimbabwe, Gambia, Benin, Ethiopia and Rwanda where DMFT values ranged from 1.9–8.4 [20]. The caries prevalence for the 35–44-year-old age group were reported as 100.0% in Greece and the Islamic Republic of Iran, 99.2% in Germany, 94.6% in Indonesia and 80.0% in Pakistan [20]. At 58.2% the caries prevalence in this study shows a better situation than many developed and developing countries [20].

The DMFT value for individuals aged 65 years and over was 22.17 in this study. This value was 2-fold worse than accepted by WHO and was similar to values from developing countries, but higher than many developing countries [20]. Our study showed caries prevalence of only 16.7% in this age group compared with 100.0%



for Belarus and Slovenia and 98.6% for Indonesia [20].

The high prevalence of poor dental health observed in this adult population is characterized by a very high global DMFT index and an excessive number of dental extractions. People with a low family income and those with a low level of education have their teeth extracted more often. It is important to encourage these people to choose conservative treatment more often by promoting dental care utilization and by facilitating financial accessibility to these services [21]. The average length of education in this study (5.2 years) was lower than in most countries and there were few people with jobs with high salaries. Most people prefer to have a tooth extracted instead of going for restorative treatment due to the high price of oral health services. In addition to dental disease, low levels of education and income and customs of oral hygiene might affect the decision about tooth extraction.

The increase of DMFT with age is expected and is compatible with the results of other studies [22,23]. The percentage of the sample with positive SiC in the elderly was more than the young due to the increased DMFT with age. In this study, age was a statistically significant factor in the rate of positive SiC. Compared with the age group 18–24 years, the percentage with positive SiC risk was 5.73 times higher at age 25–34 years; 15.99 times at age 35–44 years and 56.98 times at age 45 and over.

In this study, the percentage of people with positive SiC in females was significantly higher than in males and regression analysis showed that the risk of positive SiC for females was 1.83 times than males. This agrees with some studies [23,24] but not a study reporting higher DMFT values for men [25]. The percentage with positive SiC in married people was higher than

unmarried people, but this difference was not statistically significant, a result that disagreed with one study [26]. There was also no positive correlation between the SiC value and the number of children in the family.

Our study agrees with studies reporting that people born in rural areas had higher DMFT than those born in urban areas [6,27]. The risk of positive SiC was 1.41 times for people born in rural areas compared with the urban areas. It should be taken into consideration that the people born in rural areas were older and younger people take better care of their dental health than the elderly. This study does not agree with a study in the United States reporting no significant difference between urban and rural adults [28].

There was no a positive correlation between the SiC value and years of education. The negative correlation between the percentage with positive SiC and education level disagreed with some studies [9,27]. It was in agreement with one study reporting that there was no significant difference by educational level [10]. Unlike another study [29] there was no positive correlation between the SiC value and occupation. In a study in Japan lower household income was generally associated with a higher likelihood of health risk behaviour [29].

The percentage with positive SiC was less among the people who brush their teeth regularly, but this difference was not statistically significant. This finding is not in accordance with studies reporting that regular toothbrushing increased the level of oral health [30,31].

Other studies generally examined one or more factors related to DMFT index or dental caries. Most of these studies used bivariate analysis of risk indicators. In our study, several risk indicators of SiC index values were taken into consideration. Age,

sex, marital status, birth place, education, occupation, number of children and tooth-brushing were evaluated within the scope of dental care together with the simultaneous impact.

Strategies promoting oral health that are specified in some studies may guide the development of oral health in Turkey [32–35]. The planning and implementation of any strategy for oral health status improvement is crucial, alongside the country's infrastructure development.

## Conclusion

In conclusion, sociodemographic factors such as age, sex and birth place origin are significant factors affecting the the SiC index. Improvements in oral hygiene practices and socioeconomic status can decrease the SiC index value and improve the oral health of the adult population. In addition our study results suggest the need for better services to improve the dental status of Turkish adults.

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