

*DENTAL CARIES AND ORAL HEALTH BEHAVIOR ASSESSMENT AMONG  
PORTUGUESE ADOLESCENTS*

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## Abstract

**Introduction:** It is during the school phase that children and adolescents consolidate healthy behaviors, which will contribute to the decrease of diseases, especially in the reduction of dental caries. The main objective of the present study was to assess the decayed, missing and filled deciduous and permanent teeth index and oral health behaviors among Portuguese adolescents.

**Materials and methods:** An observational cross-sectional study was designed including a sample of 694 adolescents between the ages of 12 and 18 years old from five public schools in the Viseu and Guarda districts, Portugal. After a self-administered questionnaire was filled out by the participants, a clinical examination was carried out in order to assess oral status and dental caries identification. A descriptive analysis of the variables was performed using the Chi-square, Mann-Whitney and Kruskal-Wallis tests ( $p < 0.05$ ).

**Results:** The decayed, missing and filled permanent teeth index was  $2.91 \pm 2.9$  and the decayed, missing and filled deciduous teeth index was  $1.10 \pm 1.4$ . Of the total sample, 73% consumed sugary food on a daily basis, 54.7% drank bottled water, 50.1% considered oral health good, 70.8% did not report pain in the last 12 months, but noticed gingival bleeding (51.5%). Most adolescents (79.4%) brushed their teeth daily and 60% did not use dental floss. Of the total sample, 96.4% had a dental appointment in the last 12 months, being 46.4% due to prevention treatments. The high decayed, missing and filled deciduous teeth index was associated with low maternal scholarship, male gender and living in a rural residence area ( $p < 0.05$ ). Adolescents who brush their teeth daily presented a good perception about their oral health ( $p < 0.001$ ).

**Conclusions:** Portuguese adolescents presented a low decayed, missing and filled deciduous and permanent teeth index. The decayed, missing and filled deciduous teeth index was associated with sociodemographic factors. Oral hygiene habits were associated with self-perception of oral health. It is suggested that oral health promotion and prevention programs should be improved in schools in order to reduce the risks of oral disease development.

## 1 **Introduction**

2 Dental caries is an ancient disease in the history of mankind being considered today as a public health  
3 issue among modern civilization.(1) According to the World Health Organization (WHO) values, for  
4 the index of permanent ddecayed, missing and filled permanent teeth (DMFT) at 12 years, Portugal  
5 was among the countries with low prevalence of caries with the value of 1.48, reaching the  
6 recommended value for the European Region in 2020 (1.50) already in 2006.(2) However, among  
7 adolescents with 15 years of age, this index was 3.04.(3) These values, especially among children, are  
8 due to the increase in medical-dental treatments resulting from contracting processes with the private  
9 sector for the provision of medical-dental care, integrated in the National Program for Oral Health  
10 Promotion of the Ministry of Health of Portugal (3). However, there is scarce information in the  
11 literature about the distribution of DMFT and its associated risk factors among adolescents, which  
12 makes it difficult to develop preventive programs and the organization of health care adapted to the  
13 real needs of the population.

14 Another program of importance for oral health is the National School Health Program, which aims to  
15 promote and protect health and prevent disease in the educational community. The program considers  
16 that the school has become increasingly prominent in the health of children, adolescents and the rest of  
17 the educational community, since it is in school that children and adolescents spend most of their time  
18 assimilating new learning and knowledge, transmitting them to the family context.(4)

19 In this sense, several oral health prevention activities can be implemented in schools to reduce dental  
20 caries and other oral diseases, such as discussing the reduction of sugar consumption in the diet,  
21 correct tooth brushing, increase young people's perception of gum bleeding and pain, and educate  
22 schoolchildren about the importance of regular dental check-up appointments and the need for fluoride  
23 application and use.(5-9)

24 Both childhood and adolescence are periods of life that represent a greater risk for the development of  
25 dental caries, in which health behaviors are consolidated, with emphasis on oral hygiene and eating  
26 habits.(10) The lack of healthy lifestyle habits during childhood and adolescence can be an important

27 risk factor for adulthood, and may contribute to serious dental, functional, physical and psychological  
28 impairment and consequently reduce quality of life.(11)

29 The present study consists in the assessment of the decayed, missing and filled teeth index in the  
30 deciduous and permanent dentition (dmft and DMFT, respectively) among Portuguese adolescents and  
31 identification of the risk factors associated with the cited indexes as well as those associated with oral  
32 hygiene habits.

33

### 34 **Materials and methods**

35 The present study is an observational cross-sectional study and obtained approval by the Health  
36 Sciences Institute of the Universidade Católica Portuguesa and the formal authorization of the  
37 participating schools. The informed and explicit consent of the adolescents participating in the study  
38 and their legal guardians was also received. A total of 649 adolescents between the ages of 12 and 18  
39 years old from five public schools in the Viseu and Guarda districts (Aguiar da Beira, Mundão,  
40 Abraveses, Mangualde and Satão) during the year 2017 participated in this study. All schools  
41 participated in the community oral health program "My Best Smile" developed by Institute of Health  
42 Sciences of the Universidade Católica Portuguesa.

43 Data were collected on socio-demographic situation, eating habits, self-perception of oral health, oral  
44 hygiene habits and access to medical-dental services of study participants. For this, the self-applied  
45 questionnaire was used, with the following variables:

- 46 • Sociodemographic characterization: age, gender, parents' scholarship and residence area.
- 47 • Eating habits: consumption of sugary foods and type of water consumed.
- 48 • Self-perception of oral health: how the participants describe oral health, self-reported tooth  
49 and gingiva pain, and gingival bleeding during the last 12 months.
- 50 • Characterization of oral hygiene habits: daily brushing, mouthwash with fluoride, use of dental  
51 floss.
- 52 • Access to medical-dental services: dental appointments, frequency, type of service and reason  
53 for the dental appointment.

54 After completing the questionnaire by the participants, the researchers performed the clinical  
55 examination using the dmft and DMFT indexes following the criteria of the World Health  
56 Organization. The examination was performed by a previously calibrated examiner and scorer. It  
57 occurred in a reserved environment at the school, with the adolescent sitting in front of the spotlight  
58 and the examiner standing.

59 Statistical analysis was performed using SPSS-IBM software version 24.0. In the descriptive statistical  
60 analysis, absolute and descriptive frequencies were used for variables with nominal measurement  
61 level, mean as a measure of central tendency and standard deviation as a measure of dispersion for  
62 interval variables (12).

63 The Chi-square test was used to verify possible associations between dmft and DMFT among the  
64 independent variables: age, gender, parents' educational qualifications and residence area. The  
65 association between oral hygiene habits and participants' description of oral health (self-perception)  
66 was assessed.

67 In the interval variables such as age, it was verified that the criteria of proximity to the normal  
68 distribution were not met. For these variables and for ordinal variables, non-parametric statistical tests  
69 were used. The Mann-Whitney U was used to test differences between two groups, for three or more  
70 groups the Kruskal-Wallis test was used.

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## 72 **Results**

73 The sample presented an average of 13.9 years of age. Of the 694 participants, 360 (51.9%) belonged  
74 to the male gender and 334 (48.1%) to the female gender (table 1).

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Table 1- Descriptive statistics of the sample studied, by gender.

Gender	n	Age				
		%	Minimum	Maximum	Average	Standard deviation
Male	360	51.9	12	18	13.8	1.8
Female	334	48.1	12	18	14.0	1.8
Total	694	100.0	12	18	13.9	1.8

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80 On average, the sample had 1.95 decayed teeth. Two hundred and eighty-one adolescents had 1-2  
 81 decayed teeth (29.2%) and 252 adolescents had no decayed teeth (39.3%). Lost teeth presented an  
 82 average of 0.17. Most of the adolescents had not lost any teeth (n=574, 89.5%). The filled teeth had a  
 83 mean of 0.81. Most of the adolescents had no filled teeth (n=418, 65.2%). The DMFT showed an  
 84 average of 2.91. The DMFT score was one to three for 36.9% of the sample (table 2).

85 Regarding deciduous dentition, caries was on average 1.22 (n=157), with 49% of the adolescents with  
 86 no decayed tooth. In the lost primary teeth, a mean of 0.17 was observed. Most of the adolescents  
 87 observed had no deciduous tooth lost (n=144; 91.7%). The majority of the adolescents had no filled  
 88 teeth (n=143; 91.1%). The DMFT presented an average of 1.10. The DMFT score ranged from zero to  
 89 51% (n = 80) of the sample (table 2).

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Table 2 – DMFT and dmft scores among the studied sample.

DMFT and dmft	Minimum	Maximum	Average	Standard deviation
Decayed permanent teeth (n=641)	0	12	1.95	2.3
Missing permanent teeth (n=641)	0	7	0.17	0.6

Filled permanent teeth (n=641)	0	11	0.81	1.4
DMFT (n=645)	0	15	2.91	2.9
Decayed deciduous teeth (n=157)	0	7	1.22	1.7
Missing permanent teeth (n=157)	0	4	0.17	0.6
Filled permanent teeth (n=157)	0	5	0.17	0.7
dmft (n=157)	0	7	1.10	1.4

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93 Table 3 shows that most adolescents reported consuming sugary foods at times (n=316, 73%), and  
 94 reported consuming bottled water (n=169, 54.7%). In oral hygiene habits, half of the adolescents  
 95 considered having "good" oral health (n=218, 50.1%). Most of the adolescents did not present dental  
 96 pain in the last 12 months (n=305, 70.8%). Regarding gingival hemorrhage or gingival pain, the  
 97 adolescents did not present these symptoms (n=210; 48.5%).

98 Regarding oral hygiene habits, most adolescents (n=346, 79.4%) stated that they brush their teeth  
 99 every day, while 90 (20.6%) adolescents do not brush their teeth daily, and 388 (60%) do not use  
 100 dental floss. Regarding fluoride mouthwash, the majority of the adolescents affirmed to perform this  
 101 action (72.1%). When questioned about where they performed mouthwash, the majority of the  
 102 adolescents answered that they did at home (n=143; 57.4%) (table 3).

103 Still on table 3, with regard to access to medical-dental services, 361 (61.4%) had a dental  
 104 appointment during the last 12 months. The most frequent reason for a dental appointment was  
 105 curative dental treatment (n=244, 44.6%). The dental appointment site occurred mainly in the private  
 106 dental office (n=370; 88.7%).

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112 Table 3 – Distribution of the frequency of eating habits, self-perception of oral health, oral hygiene

113 habits and access to dental services among the adolescents.

Variables analyzed	n	%
Eating habits		
<i>Sugary food consumption</i>		
No	11	2.5
Rarely	70	16.2
Sometimes	316	73.0
Everyday	36	8.3
<i>Water consumption</i>		
Public supply	55	17.8
Well	54	17.5
Bottled	169	54.7
Unknown	31	10.0
Oral health self-perception		
<i>Oral health description</i>		
Good	257	59.0
Weak	8	1.8
Sufficient	170	39.1
<i>Toothache in the last 12 months</i>		



	No	305	70.8
	Yes	126	29.2
	<i>Gum bleeding and pain in the last 12 months</i>		
	No	210	48.5
	Yes	223	51.5
Oral hygiene habits	<i>Daily toothbrushing</i>		
	No	90	20.6
	Yes	346	79.4
	<i>Dental floss use</i>		
	No	388	60.0
	Yes	200	40.0
	Use of fluoride mouthwash		
	No	43	14.5
	Yes	30	10.2
	Unknown	91	30.8
	<i>Where fluoride mouthwash is done</i>		
	Home	143	57.4
	School	90	36.1
	Dental office	5	2.0

	Other	11	4.4
Access to medical-dental services	<i>Dental appointment in the last 12 months</i>		
	No	21	3.6
	Yes	568	96.4
	<i>Dental appointment reason</i>		
	Dental treatment	243	44.6
	Prevention	210	46.4
	<i>Where was the last dental appointment</i>		
	Public health centre	47	11.3
	Private dental office	310	88.7

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115 In table 4, the DMFT did not obtain statistically significant associations with sociodemographic  
 116 factors. For dmft, there was a statistically significant correlation between the scholarship of the  
 117 mother, male gender and residence area ( $p < 0.05$ ).

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119 Table 2– Association between parents' scholarship and adolescents' DMFT and dmft (presented in  
 120 average scores).

Father's scholarship	<4 grade	4-6 grade	7-9 grade	10-12 grade	Higher education	p
DMFT	290.02	272.28	245.52	253.47	234.45	0.148
dmf	69.42	67.62	61.04	51.89	59.50	0.425

121	Mother's	<4 grade	4-6 grade	7-9	10-12	Higher	p
122	scholarship			grade	grade	education	
123	DMFT	284.54	285.45	258.56	278.68	240.10	0.215
124	dmft	53.10	74.62	65.52	44.24	65.35	0.008
125							
126	Gender	Male	Female				p
127	DMFT	321.25	324.86				0.803
128	dmft	85.59	71.42				0.036
	Residential area	Village	Town	City			p
	DMFT	314.95	277.98	365.81			0.086
	dmft	74.20	85.97				0.001

129 Adolescents who brush their teeth every day have a more positive perception of their oral health than  
 130 subjects who do not ( $p < 0.001$ ). No differences were observed between those using and not using  
 131 dental floss in the perception about their oral health ( $p = 0.565$ ). The perception of oral health is not  
 132 correlated with the number of daily brushings ( $p = 0.132$ ).

133

### 134 Discussion

135 In the present study there were no differences in distribution among male and female adolescents.  
 136 Regarding the DMFT index, this was higher than that found in the National Study of Prevalence of  
 137 Oral Diseases published in 2008, in Portugal (DMFT index=1.48). However, when compared to  
 138 another study, such as that of Barata *et al.*, the DMFT index was lower.(13) This is because, Barata *et*  
 139 *al.*, found an average DMFT index of around 4.05 among Portuguese students, and the presence of

140 caries in 71.8% of the participants.(13) In Brazil, a study also performed with adolescents showed an  
141 average DMFT index of 3.28.(5)

142 Adolescents presented 1.95 decayed teeth, ranging from 0 to 12 teeth. In addition, 35.7% of the  
143 sample presented a greater burden of disease (4 or more decayed teeth). These data are important  
144 because it identifies a group of adolescents with a higher number of dental caries, and another one in  
145 which the disease is very little or totally absent, evidencing a possible polarization.  
146 According to Peres *et al.*, the decline of dental caries in several countries was accompanied by the  
147 phenomenon of polarization, which consists in the concentration of most diseases and treatment needs  
148 in a small part of the population. (14) We have moved from a situation of high disease prevalence to a  
149 scenario in which a large proportion of individuals are found to be free of dental caries. The non-  
150 uniform distribution also occurs in several studies and is associated with social inequalities (15), since  
151 the situation is more severe in the economically disadvantaged and low-grade classes.  
152 Regarding the dmft index, there was an average of 1.10 deciduous decayed teeth ranging from 0 to 7  
153 deciduous decayed teeth, among 69% of the sample. Despite the homogeneous situation of caries  
154 distribution in this segment, it is necessary to maintain attention for preventive care. Comparing these  
155 results with previous studies, also performed in the region of Viseu, it is observed that there was a  
156 higher prevalence of caries in the results found. Amaral *et al.*, in a study with 76 children, identified  
157 the presence of decayed teeth in only 15.3% of the sample.(16)

158 The experience of caries among 12-year-old adolescents is strongly associated with those with less  
159 privileged socioeconomic conditions, whose parents, especially mothers, have a lower educational  
160 level and there are strong indications of the association between the disease and the male gender.(17-  
161 19) The residence area is another factor that contributes to the prevalence of dental caries.(20) This  
162 information corroborates with the present study, which found a significant association between the  
163 mother's scholarship, adolescents' gender and residence area for the dmft variable.  
164 In addition to social factors, it is known that the dental caries index is related to the subjects'  
165 behavioral aspects. Thus, in order to think about preventive actions, it is necessary to understand what  
166 care is taken in the daily activities of the adolescents (21).

167 In this sense, some of the measures to prevent the prevalence of dental caries were investigated in the  
168 present study, such as sugar consumption. The frequency of consumption of foods with sucrose has  
169 been constantly associated with the prevalence of dental caries among younger people.(5,22)  
170 However, not always adolescents who consume higher amounts of cariogenic foods develop caries,  
171 since the manifestation of caries is dependent on the time of exposure and other primary and  
172 secondary etiological factors. The present results showed that 73% of adolescents stated that they  
173 consume sugar daily, a pattern considered negative for food, and that it may contribute to other health  
174 problems such as obesity and diabetes.(16) Regarding the association between eating habits, it is also  
175 important to investigate the consumption of fluoridated water, since this is an effective preventive  
176 measure against dental caries (23). About this, most adolescents reported consuming bottled water, but  
177 they do not recall the use of fluoride in the daily mouthwash.

178 Oral hygiene habits are essential in the removal of plaque and food debris.(21,24) According to the  
179 Health General Directory of Portugal, in 2008, approximately 50% of children aged 6 years and  
180 around 69% of young people aged 12 and 15 have the daily habit of toothbrushing.(3) To confirm this  
181 information, a study carried out in Portugal found that 23.5% of a sample of 7644 adolescents brush  
182 their teeth twice a day, and only 4.4% use dental floss.(25) The present study identified a greater  
183 frequency in the use of the toothbrush compared to the use of the dental floss. The use of dental floss  
184 prevents the development of dental caries on the interproximal surfaces of the teeth and periodontal  
185 diseases , and its use is recommended, making it essential to plan educational actions for its  
186 use.(26,27)

187 For dental appointments, they should be regular or at least once every six months, which contributes to  
188 the early and immediate diagnosis of oral diseases, information on the most appropriate treatments and  
189 application of preventive measures, such as topical application of fissure sealants and fluorides.(28) It  
190 has been identified in studies that Portuguese young people frequently have a dental appointment (in  
191 the last 12 months), and most are check-up dental appointments.(25) This result is interesting because  
192 they may be the result of public health policies that are promoting greater access to the Portuguese  
193 population for medical-dental health care. There is a tendency in the literature to assess the subject's

194 own perception of their oral health. Self-perception of the oral condition has been used as an indicator  
195 of individuals' behavior regarding the search for medical-dental treatments.(29) There is evidence that  
196 people who identify a good oral health condition have a lower prevalence of dental caries.(29) Thus, it  
197 is plausible the association found between good oral health habits and the good perception of oral  
198 health among adolescents.

199

## 200 **Conclusions**

201 The results obtained in the present study were consistent with those described in the literature and  
202 indicate that actions to control dental caries among adolescents should be strengthened, and especially  
203 aimed at the development of more favorable and efficient oral health behaviors. The results also  
204 demonstrated that a better oral hygiene habit, such as frequent toothbrushing, is associated with a more  
205 positive perception of oral health. Portuguese adolescents presented a low DMFT and dmft index and  
206 are was associated with sociodemographic factors. Oral hygiene habits were associated with self-  
207 perception of oral health. It is suggested that oral health promotion and prevention programs should be  
208 improved in schools in order to reduce the risks of oral disease development.

209

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213

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## 290 **Ethical declarations**

291 The study was approved by the Health Sciences Institute of the Portuguese Catholic University and  
292 obtained formal authorization from the participating schools. The study was in accordance with the

293 1964 Helsinki Declaration on Ethics Approval and consent to participate in research. The Free and  
294 Informed Consent Terms were obtained from the parents before starting the study.

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296 **Disclosure Statement**

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302 **Author Contributions**

303 Conceived and designed the experiments: NJV JM. Performed the experiments: NJV JM. Analyzed  
304 the data: NJV JM MHC. Contributed reagents/materials/analysis tools: NJV MHC JM IPC. Wrote the  
305 paper: NJV MHC JM IPC MCM.

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