Dental caries and oral health behavior assessments among portuguese adolescents.

Caries dental y evaluaciones del comportamiento de salud bucal en adolescentes portugueses.

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Abstract: Introduction: Adolescents have a high risk of developing caries in Portugal. The present study is designed to assess dental caries experience among the adolescents by the application of DMFT index, characterize the oral health risk factors and to determine the association between caries experience and socio-demographic variables. The characterization of the oral health behaviors of adolescents of the central region of Portugal will help in the development of specific oral health education strategies to improve oral health among the local communities. **Material and methods:** A cross-sectional study was conducted among a convenient sample of 694 adolescents aged 12 to 18 years attending public schools in two Portuguese districts using a structured questionnaire designed to investigate oral health and behavior of participants. In addition, a clinical examination was carried out noting the decayed, missing and filled teeth. A descriptive analysis of the variables was performed using the Chi-square, Mann-Whitney and Kruskal-Wallis tests (p<0.05). A multivariate analysis was applied for analysis of the association between variables. **Results:** The mean DMFT index score of 2.91±2.9 was obtained. Of the total sample, 73% consumed sugary food daily, 50.1% considered having good oral health and 70.8% did not report pain in the last 12 months. 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, 46.4% of which was for preventive purposes. Applying the Chi-square statistical test, we verified that the adolescents who brush their teeth daily presented a good perception about their oral health (p<0.001), the DMFT index scores were associated with the residence area (p=0.01) and the presence of dental caries was associated with the perception of oral health (*p*=0.049) and sugary food intake (p=0.029).**Conclusion:** Portuguese adolescents presented a low DMFT index. The DMFT index was associated with residence area, perception of oral health and sugary food intake. Daily toothbrushing was associated with self-perception of oral health. It is suggested that oral health promotion and prevention programs should aim to reduce the risks of oral disease development.

Keywords: Dental caries; Oral health; Oral hygiene; Health education, Adolescents, DMF index.

Resumen: Introducción: Los adolescentes tienen un alto riesgo de desarrollar caries en Portugal. El presente estudio está diseñado para evaluar la experiencia de caries dental entre los adolescentes mediante la aplicación del índice CPOD, caracterizar los factores de riesgo para la salud bucal y determinar la asociación entre la experiencia de caries y las variables sociodemográficas. La caracterización de los comportamientos de salud bucal de los adolescentes de la región central de Portugal ayudará en el desarrollo de estrategias específicas de educación en salud bucal para mejorar la salud bucal entre las comunidades locales. **Material y Métodos:** Se realizó un estudio transversal en una muestra por conveniencia de 694 adolescentes de 12 a 18 años que asisten a escuelas públicas en dos distritos portugueses utilizando un cuestionario estructurado diseñado para investigar la salud bucal y el comportamiento de los participantes. Además, se llevó a cabo un examen clínico observando los dientes cariados, faltantes y obturados. Se realizó un análisis descriptivo de las variables mediante las pruebas de Chi-cuadrado, Mann-Whitney y Kruskal-Wallis (p <0,05). Se aplicó un análisis multivariado para el análisis de la asociación entre variables. **Resultados:** Se obtuvo la puntuación media del índice CPOD de 2,91 ± 2,9. Del total de la muestra, el 73% consumía alimentos azucarados diariamente, el 50,1% consideró tener buena salud bucal y el 70,8% no refirió dolor en los últimos 12 meses. La mayoría de los adolescentes (79,4%) se cepillaban los dientes a diario y el 60% no usaba hilo dental. Del total de la muestra, el 96,4% tuvo cita con el dentista en los últimos 12 meses, de la cual el 46,4% fue con fines preventivos. Aplicando la prueba estadística de Chi-cuadrado, verificamos que los adolescentes que se cepillan los dientes diariamente presentaban una buena percepción sobre su salud bucal (p <0.001), las puntuaciones del índice CPOD se asociaron al área de residencia (p = 0.01) y la caries dental se asoció con la percepción de salud bucal (p = 0,049) y con la ingesta de alimentos azucarados (p = 0,029). **Conclusión:** Los adolescentes portugueses presentaron un índice CPOD bajo. El índice CPOD se asoció con el área de residencia, la percepción de salud bucal y la ingesta de alimentos azucarados. El cepillado diario de los dientes se asoció con la autopercepción de la salud bucal. Se sugiere que los programas de promoción y prevención de la salud bucal deben ser enfocados en reducir los riesgos de desarrollo de enfermedades bucodentales.

Palabra Clave: Caries Dental; Salud Bucal; Higiene Bucal; Educación en Salud; Adolescente; Índice CPO.

INTRODUCTION.

Dental caries is considered as one of the most prevalent diseases and is also considered nowadays as a public health issue in modern society.[1] According to the World Health Organization (WHO), a DMFT index of 1.48 reported among 12 years old children in Portugal showed that this country was among the countries with lower prevalence of caries experience, reaching the recommended value of 1.5 proposed for the European Region in 2020.[2] However, among the adolescents who were 15 years of age, this index was 3.04.(3) This value, among these individuals, explained the increased medical and dental treatments provided by the National Program for Oral Health Promotion of the Ministry of Health of Portugal for this age group.[3]

The National School Health Program which aims to promote and protect health and prevent disease among the children community is a very important program.[4] This program considers that the school has become increasingly fundamental to the health of children, adolescents and the rest of the educational community, since it is there that children and adolescents spend most of their time assimilating new learning methods and knowledge, that must be transmitted among the family context.[4] Therefore, several oral health prevention activities can be implemented in schools in order to reduce dental caries and other oral diseases, such as discussing the reduction of sugar intake in the diet, correct tooth brushing and educating the adolescents about the importance of regular dental check-up appointments and the need for fluoride application and use.[5-9]

There is limited information on the distribution of DMFT and caries-associated risk factors among the adolescents. This certainly makes it difficult to propose and develop the most efficient preventive oral health programs that would meet the needs of this population. More studies are needed among this high-risk group before effective preventive strategies can be developed.

The present study is designed to assess dental caries experience among Portuguese adolescents by the application of the decayed, missing and filled teeth index (DMFT index), characterize the oral health risk factors and to determine the association between

caries experience and socio-demographic variables. The characterization of the oral health behaviors of adolescents of the central region of Portugal will help in the development of specific oral health education strategies to improve oral health among the local communities.

MATERIALS AND METHODS.

This study was designed as an observational cross-sectional study, where a non-probability convenient sample of 694 adolescents aged 12 to 18 years attending five public schools of the Viseu and Guarda districts (Aguiar da Beira, Mundão, Abraveses, Mangualde and Satão), were enrolled from February to December of 2017.

The inclusion criteria were adolescents between ages 12 and 18 years and readiness to accept, deliver and return informed consent duly signed by their legal guardians/parents. All public schools participated in the community oral health educational program "My Best Smile" developed by the Faculty of Dental Medicine of the Universidade Católica Portuguesa. This program is set up for the development of oral health promotion sessions with adolescents at their schools and intra-oral observation for detection of oral lesions, mainly, dental caries.

A self-applied open and close-ended questionnaire was used to collect data relating to the following:

- Sociodemographic variables: age, gender, parents' education and residence area.

- Eating habits: sugary food intake and type of water consumed.

- Self-perception of oral health: participants' perception of their oral health, self-reported tooth and periodontal pain, and gingival bleeding during the last 12 months.

- Characterization of oral hygiene habits: daily brushing, mouthwash with fluoride, use of dental floss.

- Access to medical-dental services: dental appointments, frequency, type of service and reason for the dental appointment.

Clinical examination of the oral health status was carried out in addition according to the WHO criteria to determine the prevalence of dental caries and the DMFT index.[2] The teeth were clinically examined using visual-tactile method with the aid of a sterile dental mirror and probe for cavitation detection only (approved by the WHO for caries diagnosis) in a classroom under standardized conditions recommended by the WHO. Cotton rolls and gauze were available to remove moisture when necessary. Standard sterilization procedures were followed and proper personal protection equipment such as gloves and masks were used.

The studied sample represents the entire school group of the area, and 81.3% of its students were enrolled in the study. Questionnaires without information about gender and age and those from individuals who failed to return the signed informed consent by their parents were excluded from the study.

The examination was performed by a competent and previously calibrated examiner and scorer. It occurred in a reserved environment at the school, with the adolescent sitting comfortably on a chair in front of a standing examiner. Each of the examiners examined 12 adolescents previously, obtaining a concordance value of 89.9% inter-examiners and 88.6% intra-examiners.

Data analysis was carried out using the Statistical Package for Social Sciences (IBM-SPSS) version 24.0. In the descriptive statistical analysis, absolute and descriptive frequencies were used for variables with nominal measurement level, mean as a measure of central tendency and standard deviation as a measure of dispersion for interval variables.(12)

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

In the interval variables such as age, it was verified that the criteria of proximity to the normal distribution were not met. For these variables and for ordinal variables, non-parametric statistical tests were used. The Mann-Whitney U was used to test the differences between two groups, for three or more groups the Kruskal-Wallis test was used. A multivariate analysis—logistic regression—was applied for analysis of the association between variables.

This research involving human participants was performed in accordance with the Declaration of Helsinki and it was approved by the Ethics Committee of the Universidade Católica Portuguesa, Portugal. The information collected by the questionnaires was provided voluntarily and confidentially was preserved. The anonymity of the information collected was guaranteed by telling adolescents not to sign their

names or write down any other form of identification in any part of the questionnaire.

RESULTS.

Out of the 694 participants, 360 (51.9%) were males while the remaining 334 (48.1%) were females. The average age of the participants was 13.9 years of age (table 1).

The DMFT score ranged from 0 to 15 and showed an average of 2.91±2.9. The average score for dental caries among the permanent teeth was 1.95±2.3. Two hundred and fifty-two adolescents had no dental caries (36.3%), 281 had 1 to 2 carious teeth (40.5%) and 161 adolescents presented 3 or more carious teeth (23.2%). The average number of missing teeth was 0.17. Most of the adolescents had never experienced permanent tooth loss (89.5%). The average number of filled teeth was 0.81. Most of the adolescents had no filled teeth (65.2%), table 2.

Table 3 shows that most of the participants reported consuming sugary foods sometimes (n=316, 73%), and reported consuming bottled water (n=169, 54.7%). Regarding self-perception of oral health, most of the adolescents considered themselves as having good oral health (n=257, 59.0%). Most of the adolescents did not experience dental pain in the last 12 months (n=305, 70.8%). Regarding gingival bleeding and / or pain, only 210 participants (48.5%) did not report any type of symptoms.

Most adolescents (n=346, 79.4%) stated that they brush their teeth every day and 388 (60%) indicated that they do not use dental floss. Regarding fluoride mouthwash, most of the adolescents declared performing this action (72.1%). When questioned about where they performed mouthwash, many of the adolescents answered that they did it at home (n=143, 57.4%) (Table 3).

Regarding oral health care utilization, 568 (96.4%) had a dental appointment during the last 12 months. The most frequent reason for a dental appointment was curative dental treatment (n=243, 44.6%). The dental appointment occurred mainly in the private dental centre (n=310; 88.7%).

Adolescents who brush their teeth every day have a more positive perception of their oral health than subjects who do not ($p<0.001$). No differences were observed between the daily use of dental floss and the perception about their oral health ($p=0.565$). The perception of oral health did not correlate with the number of (number of times the participants brush daily was not investigated) daily tooth brushing ($p=0.132$).

After adjustment by non-conditional logistic regression for eating habits, self-perception of oral health, oral hygiene habits and dental appointment in the last 12 months and the presence of dental caries among the adolescents, the findings of the present study demonstrate that the presence of dental caries was associated with the perception of oral health (OR=0.17 95% CI=0.01–0.25, $p=0.049$) and sugary food intake (OR=0.18 95% CI=0.01–0.26 $p=0.029$) (Table 3).

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

| Gender | N | % | Age (years) | | | |
			Mínimum	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**

Table 2. DMFT scores among the studied sample.

DMFT	Minimum	Maximum	Average	Standard Deviation
Dental caries among permanent teeth (n=694)	0	12	1.95	2.3
Missing permanent teeth (n=694)	0	7	0.17	0.6
Filled permanent teeth (n=694)	0	11	0.81	1.4
DMFT (n=694)	0	15	2.91	2.9

Table 3. Distribution of the frequency of eating habits, self-perception of oral health, oral hygiene habits and dental appointment in the last 12months among the adolescents.

Variables analyzed		n	%
Eating habits	Sugary food intake		
	No	11	2.5
	Rarely	70	16.2
	Sometimes	316	73.0
	Everyday	36	8.3
	Water consumption		
	Public supply	55	17.8
	Well	54	17.5
	Bottled	169	54.7
	Unknown	31	10.0
Oral health self-perception	Good	257	59.0
	Weak	8	1.8
	Sufficient	170	39.1
	Toothache in the last 12 months		
	No	305	70.8
	Yes	126	29.2
	Gingival bleeding and/ or pain in the last 12 months		
	No	210	48.5
	Yes	223	51.5
Oral hygiene habits	Daily toothbrushing		
	No	90	20.6
	Yes	346	79.4
	Dental floss use		
	No	388	60.0
	Yes	200	40.0
	Use of fluoride mouthwash		
	No	43	11.2
	Yes	249	65.0
	Unknown	91	23.8
	Where fluoride mouthwash is used		
	Home	143	57.4
	School	90	36.1
	Dental office	5	2.0
	Other	11	4.4
Access to medical-dental services	Dental appointment in the last 12 months		
	No	21	3.6
	Yes	568	96.4
	Dental appointment reason		
	Dental treatment	243	44.6
	Prevention	210	46.4
	Where was the last dental appointment		
	Public health centre	47	11.3
	Private dental office	310	88.7

Table 4. Association between socio-demographic variables and adolescents' DMFT average scores.

Father´s education	<4th grade	4-6th grade	7-9th grade	10-12th grade	Higher education	p-value
DMFT	2.90	2.72	2.45	2.53	2.34	0.15
Mother´s education	**<4th grade**	**4-6th grade**	**7-9th grade**	**10-12th grade**	**Higher education**	**p-value**
DMFT	2.84	2.85	2.58	2.78	2.40	0.22
Gender	**Male**	**Female**				**p-value**
DMFT	3.21	3.24				0.80
Residential area	**Rural**	**Urban**				**p-value**
DMFT	3.14	3.51				0.01

Mann-Whitney U was used to test differences between two groups, for three or more groups, the Kruskal-Wallis test was used, applying a significance level of 5% ($p<0.05$).

DISCUSSION.

Both childhood and adolescence are periods of life that represent a greater risk for the development of dental caries, in which health behaviors are consolidated, with emphasis on oral hygiene and eating habits.[10] The lack of healthy lifestyle habits during childhood and adolescence can be an important risk factor for adulthood, and may contribute to serious dental, functional, physical and psychological impairment and consequently reduce quality of life.[11]

In the present study, there was no major difference in the distribution of male and female participants. Regarding the DMFT index, the value reported in this study (2.91) was higher than that found in the National Study of Prevalence of Oral Diseases published in 2008 (1.48).[3] However, when compared to that of Barata et al., the present DMFT index was lower.[13] This is because, Barata *et al.*,[13] found an average DMFT index of 4.05 among Portuguese students, and the presence of caries in 71.8% of the participants. In Brazil, a study also performed among adolescents showed an average DMFT index of 3.28.[5]

The participants presented an average score of 1.95 carious teeth, the number of carious teeth ranged from 0 to 12 teeth. In addition, 23.2% of the sample presented a greater burden of the disease (3 or more dental caries). This data is important because it identifies a group of adolescents with a higher level of dental caries, and another one in which the disease is very minimal or totally absent and thus suggesting a possible polarization.

According to Peres *et al.*,[14] the decrease in the incidence of dental caries in several countries was accompanied by polarization, which implies that most the cases and treatment needs were concentrated in a small part of the population. We have moved from a situation of high disease prevalence to a situation in which a large proportion of the population are found to be free of dental caries. This is associated with social inequalities, since the situation is more severe among the economically disadvantaged population.[15] Despite the declining trend in caries experience, it is still necessary to remain attentive regarding preventive care. Amaral *et al.*,[16] in a study carried out in Viseu, Portugal, identified the presence of dental caries in only 15.3% of the sample which was far lower than the finding from the present study.

The experience of dental caries among 12-year-old adolescents is strongly associated with those with less privileged socioeconomic conditions, whose parents, especially mothers, have a lower educational level, and there are strong indications of the association between the disease and the male gender.[17-19] The residence area is another factor that contributes to the prevalence of dental caries.[20] This is corroborated by the present study and demonstrates the clear association between oral diseases and socio-economic status, as evident by the fact that the prevalence of dental caries is higher among adolescents that live in rural areas. In addition to social factors, it is known that the dental caries index is related to the subjects' behavioral aspects. Thus, in order to plan preventive actions, it is necessary to understand the predisposing factors in the daily activities of adolescents.[21]

Therefore, some of the factors associated with preva-lence of dental caries were analyzed in the present study, such as sugar intake. The frequency of consumption of foods with sucrose has been constantly associated with the prevalence of dental caries among younger people.[5,22]

However, not all adolescents who consume higher amounts of cariogenic foods develop caries, since the manifestation of caries is dependent on the time of exposure and other primary and secondary etiological factors. The present results showed that 73% of ado-lescents stated that they consume sugar daily, a pattern considered negative to good oral health, and which may also contribute to other health problems such as obesity and diabetes.[16]

Regarding the association between eating habits and caries, it is important to study how preventive actions like daily tooth brushing, use of floss and fluoride mouthwash are utilized since they are effective preventive measures against dental caries.[23] Oral hygiene habits are essential for the removal of plaque and food debris.[21,24] According to the Health General Directory of Portugal, in 2008 approximately 50% of children aged 6 years and around 69% of young people aged 12 and 15 years had the habit of brushing daily.[3] To confirm this information, a study carried out in Portugal found that 23.5% of a sample of 7,644 adolescents brushed twice a day, and only 4.4% used dental floss.[25]

The present study found a higher frequency of the use of toothbrush compared to the use of dental floss. The use of dental floss prevents the development of dental caries on the interproximal surfaces of the teeth and periodontal disease. Its role in the prevention of these diseases and the benefits of its use makes it essential to plan educational actions that would encourage more people to use dental floss.[26,27]

There is a significant association between daily tooth brushing and self-perception of oral health. This warrants the need to reinforce this preventive oral health care habit. Dental appointments should be established on a regular basis, once every six months. This would allow to make an early diagnosis of oral diseases and immediately institute the most appropriate treatments and application of preventive measures, such as the topical application of fissure sealants and fluoride application.[28]

It has been identified in past studies that Portuguese adolescents have had a dental appointment frequently (within the last 12 months), and most are check-up dental appointments.[25]

This result is interesting because it may be the result of public health policies that are promoting greater access for the Portuguese population to medical-dental health care. The present study however, found that about half of the participants reported gingival complaints while about third reported toothache. In addition, about half of those who visited the dentist did so for curative purposes in private clinics.

The oral health care use by the participants for preventive purposes was not satisfactory and the fact that public health care facilities were not being patronized is worrisome. Oral health education needs to be pursued more passionately and the challenges discouraging people from utilizing public health care facilities need to be addressed. Since most of the participants ingest bottled water, fluoridation of this source of water may have to be considered.

There is a trend in the literature to assess people's perception of their oral health. Self-perception of the oral condition has been used as an indicator of an individual's behavior regarding needs and requests for medical-dental treatments. There is evidence that people who indicate a good oral health condition have a lower prevalence of dental caries.[29]

The present study showed that there was an association between self-perception of oral health and brushing daily, intake of sugary foods and presence of caries. Poor oral hygiene and frequent ingestion of sugary food predisposes to caries and periodontal problems, but good plaque control measures and use of mouthwash will mitigate the consequences.[3,16] Thus the association found between good oral health habits and good perception of oral health among adolescents is plausible.

CONCLUSION.

The adolescents enrolled in the study presented a DMFT score of 2.9±2.9 and the DMFT score was associated with residence area. Self- perception of oral health was associated with sugary food intake, daily tooth brushing and presence of caries. About half of the participants reported gingival complaints, about a third reported toothache while about half had visited a dentist for curative purposes.

Utilization of dental floss was low and most of the

participants patronized private dental care facilities. It is suggested that oral health promotion and prevention programs should be instituted in order to reduce the risks of oral disease development.

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