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Abstract

Background: Studies addressing the oral health status among Lebanese school children are scarce.

Aims: To assess the oral health status of Lebanese school children, and to provide epidemiological data for planning and evaluation of oral health care programmes.

Methods: We selected 7902 schoolchildren aged 12–15 years from the 6 governorates of Lebanon, using a multistage probability sampling method. Data were obtained by self-administered structured questionnaires and clinical examinations (World Health Organization methodology and criteria). Dental caries was recorded using the Decayed, Missing, and Filled Teeth (DMFT) index. Periodontal status was evaluated using the Community Periodontal Index (CPI).

Results: The mean (standard deviation) number of decayed, missing and filled teeth was 3.01 (2.927), 0.05 (0.245) and 2.14 (2.071), respectively, and the mean DMFT score was 5.20 (3.549). Among the whole tested population, the prevalence of caries was 89.5% and only 10.5% of the children were completely free of caries. Age, geographic location and school sector were the most significant risk factors for caries prevalence. Periodontal disease (CPI

score > 0) was seen in 7633 participants (96.6%). In contrast to the shallow periodontal pockets that showed a low prevalence, calculus was the most frequently detected periodontal condition in both ages (50.9% at 12 years old and 50.2% at 15 years old). Age, sex, school sector and smoking status were significantly associated with occurrence of periodontal disease.

Conclusion: Preventive and restorative public health campaigns are highly recommended to improve oral health status among Lebanese schoolchildren.

Keywords: dental caries, Lebanon, periodontal status, risk factors, school children

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Introduction

Dental caries and periodontal disease are among the major public health problems and the most prevalent oral diseases, especially in children and adolescents

(1,2). Their worldwide adverse impacts on well-being, quality of life and systemic health are well documented (3). The World Health Organization (WHO) states that oral health is part of a person's health and general well-being and it is important for a good and consistent quality of life (4). Epidemiology in oral health is a crucial area of knowledge for scientific research, providing a tool that combines clinical models and optimal protocols. Moreover, it deepens discussions about oral diseases, their synergic relationship with overall wellness, and their

potential association with biopsychosocial factors. Therefore, epidemiological studies that can provide predictive significance to clinical data are becoming important in implementing preventive strategies to reduce the incidence of dental problems (5). In developing countries, the evolutionary trend in the prevalence of oral health status is not clear. Some authors suggest that the prevalence of dental caries and periodontal diseases tends to decrease in parallel with the implementation of preventive oral care programmes and with the emergence of new lifestyles (6). The situation in Lebanon is alarming, and dental caries index (decayed, missing, and filled tooth; DMFT) in children aged 12 years has worsened from 1.2 in 1961 to 3.43 in 2018 (7). A recent study reported that the 12- and 15-year-old children and adolescents had a higher prevalence of caries history in permanent teeth of 80.38% and 90.57%, respectively, and 77.16% and 81.55% of patients were untreated (8). Unfortunately associated risk factors were never seriously investigated.

Oral health prevention programmes have traditionally focused on dental caries. However, in Lebanon periodontal diseases are widespread too, but unfortunately there is a lack of national studies in this field; especially studies that can be compared with epidemiological studies in other countries. In this context, a study conducted in 1996 highlighted a bad situation regarding the prevalence of periodontal disease among adolescents aged 15 years in Lebanon (94.5%), which was one of the highest in the Eastern Mediterranean Region (9). The lack of national epidemiological studies in Lebanon means that an accurate overview of oral health status is needed (10). These findings emphasize the importance of exploring oral health status in Lebanon, especially among adolescents, in whom diagnosis of periodontal disease and caries status and evaluation of risk factors are crucial because these diseases may progress to severe or even irreversible complications.

The aim of this epidemiological study was to evaluate oral health status of Lebanese 12- and 15-year-old school children in Lebanon, to provide reliable data to plan and evaluate national oral health care programmes.

Methods

Study sample and design

This school-based cross-sectional study was conducted from September 2018 to June 2019, among school children aged 12 (n = 3985) and 15 (n = 3917) years, selected from public and private secondary schools in the urban, suburban and rural areas of the 6 Lebanese governorates (Beirut, South Lebanon, North Lebanon, Nabatiyeh, Bekaa and Mount Lebanon). This study was approved by the ethics committee of the Azm Center for Research in Biotechnology and Its Applications, Lebanese University (document no. CE-EDST-1-2021). Informed consent was obtained from the institutional officials and participants' parents. The study sample was drawn from a larger sample representative of school children aged 12–15 years among the Lebanese population, which was derived using a stratified multistaged

randomized cluster sampling method, based on information provided by the Lebanese Ministry of Education and following WHO guidelines (11). In a second stage, all high schools (clusters) in the each governorate were listed, and the number of schools selected by simple random sampling was determined proportionally to the number of schools in the selected area. In the third stage, classes from the selected schools were chosen. The number of students to be recruited in the private or public sector in each governorate was calculated proportionally to the total number of students in each sector. A random list was prepared for public and private schools separately, and schools were selected and asked for permission to recruit participants. Examination proceeded from the first school to the next until the required sample was gathered from the location. No more than 100 participants were recruited from a single school. The same procedure was followed in both public and private schools. When a school did not give permission to recruit participants, the next school in the list was approached. The procedure used in a multicentre oral health survey (12) for the selection of classrooms within each school was also followed in the current study. If there was only 1 section for that age group, that class was included in the survey. If > 1 section was in the required age group, a random selection method was used to further select the section to be examined. In some schools, the head teacher decided the classes and sections to be examined depending on the work load in the curriculum at the time of the survey.

All surveyed students received a clinical examination in accordance with the WHO methodology and criteria (11). In the questionnaire section, the following information was registered: sex, age, location (urban, suburban and rural), smoking status, private/public sector, and presence/absence of systemic disease. Oral examinations were performed in daylight using plane mouth mirrors. Participants were examined in the classrooms by 7 calibrated examiners. Examiners were calibrated and an interexaminer agreement (k level) of ≥ 85% was reached, as recommended by WHO (11). To evaluate dental caries status, the following indices were used: decayed teeth (DT) missing teeth (MT), filled teeth (FT), and decayed, missing due to caries, and filled teeth (DMFT). The percentage of students with DMFT > 0 corresponded to the preva-lence of dental caries.

The periodontal status was assessed using Community Periodontal Index (CPI) component of the Community Periodontal Index of Treatment Needs (13). The index teeth (11,16,17,26,27,31,36,37,46 and 47) were examined at mesial and distal proximal sites on buccal and lingual/palatal sides during daylight using plane mouth mirrors and WHO-recommended periodontal probes (11). The mouth cavity was divided into 6 sextants following WHO guidelines (11). Bleeding status, presence/absence of supra- or subgingival calculus and pocket depths were then determined (13). The participants were classified as: 0 = healthy periodontium; 1= gingival bleeding after gentle probing; 2 = supra- or subgingival calculus; and 3 = pathological pockets 3.5–5.99 mm deep. Periodontitis corresponded to CPI = 3, indicating that > 1 site had a 3.5-mm or larger pocket in the index teeth. The study parameters were analysed upon considering periodontitis (CPI = 3) and nonperiodontitis (CPI ≤ 2).

Statistical analysis

SPSS version 24.0 was used for statistical analysis. The a error was set at 0.05. Descriptive statistics were generated for distribution of the school children across the various backgrounds, health characteristics and oral health indicators. Analyses were performed to evaluate the relative effect of sociobehavioural and sociodemographic characteristics (age, sex, location, school type and smoking) on oral health parameters and dental caries. Four continuous outcomes and 1 categorical variable were selected as dependent variables for univariate and multivariate analyses to explore the effects of potential predictors. The continuous dependent variables were DMFT index, DT, FT, MT and CPI. Binary logistic regression was used to assess the presence of dental caries and periodontal diseases. Univariate followed by multivariate analyses were performed to explore the effects of explanatory variables on CPI and DMFT scores. Student's t tests and analysis of variance followed by Tukey's post hoc tests were performed to compare continuous variables between groups. c2 and Fisher's exact tests were used to compare categorical variables between groups. Odds ratio with 95% confidence interval was used to assess the association between the study variables and prevalence of dental caries. Multiple linear regression for continuous dependent outcomes and logistic regression analyses for the categorical dependent outcome were carried out. All covariates associated with the outcomes at P

Results

Univariate analysis

The sociodemographic characteristics of the participants are summarized in Table 1 . In the overall sample, the mean (standard deviation; SD) number of decayed, missing and filled teeth was 3.01 (2.927), 0.05 (0.245) and 2.14 (2.071), respectively, and the mean DMFT score was 5.20 (3.549). The prevalence of decay was 89.5% and only 10.5% of the children were completely free of dental caries. For all age groups, the D-component constituted most of the caries index. The highest DMFT index was found in Bekaa (6.82) and the lowest in Beirut (4.10). Univariate analysis showed that the number of decayed teeth was significantly related to governorate, school, age and location. The number of missing teeth was significantly related to governorate and location area. The number of filled teeth was significantly related to governorate, age, sex and location. The DMFT index was significantly related to governorate, school, age and location. Univariate analysis also showed that prevalence of decay differed significantly according to governorate, school, age and location.

The CPI scores associated with the different risk factors are summarized in Table 2 . Only 3.4% of participants had healthy periodontal condition (CPI = 0).

In contrast, 44.0% of participants showed gingival bleeding (CPI = 1), 50.5% had calculus with bleeding

(CPI = 2), whereas only 2% were characterized by shallow periodontal pockets (4–5 mm; CPI = 3).

Univariate analysis of the association between sociodemographic characteristics and periodontal status is displayed in Table 3. Mean and SD of each dependent variable were used for statistical comparisons. The number of teeth with healthy periodontal condition (CPI = 0) varied significantly according to age, school, sex, smoking, governorate and location (Table 3). The number of teeth with gingival bleeding (CPI = 1) differed significantly according to age, school, governorate and location. The number of teeth with calculus and bleeding (CPI = 2) was significantly associated with age, school, sex, governorate, smoking and location. The number of teeth with periodontal pockets (CPI = 3) was significantly related to age, sex, governorate and smoking.

Multivariate analysis

The multivariate analyses of the association between sociodemographic characteristics of the children and each component of the DMFT index are illustrated in Table 4 . The number of decayed teeth was significantly elevated in children from public compared to private schools. The number of decayed teeth was also elevated in children living in a rural compared to urban and suburban areas; however, it was not significantly related to age. The number of missing teeth was significantly elevated in children living in urban compared to rural and suburban areas. It was also significantly elevated in girls compared to boys. The number of filled teeth was significantly elevated in girls compared to boys, in children aged 15 years compared to 12 years, and in children living in rural compared to urban and suburban areas. DMFT was significantly elevated in children from public schools, living in rural areas, and aged 15 years compared to 12 years. Multivariate analysis also revealed that children from public schools were 3.845 times more likely to have caries compared to children from private schools. Children from urban and suburban areas were less likely to have caries compared to children from rural areas. Children from rural areas were 1.326 times more likely to have caries compared to children from urban/suburban areas.

The multivariate analyses of the association between sociodemographic characteristics and CPI index are illustrated in Table 5 . The number of teeth with healthy periodontal condition was significantly elevated for boys, children from private schools, children aged 12 years, nonsmokers and living in suburban areas. The number of teeth with gingival bleeding (CPI = 1) was significantly elevated for children from public schools, children aged 15 years and living in suburban areas. The number of teeth with calculus and bleeding (CPI = 2) was significantly elevated for girls, children from public schools, aged 15 years and smokers; however, it was significantly lower for children living in suburban areas. The multivariate analyses also showed

that the number of teeth with periodontal pockets (CPI = 3) was significantly elevated for girls, children aged 15 years and smokers.

Three percent of missing data related to all the recorded variables was found, but this was considered insignificant and did not alter the final results.

Discussion

WHO encourages epidemiological studies to address the prevalence of different oral diseases and their associated risk factors to assist healthcare planners to design effective preventive programmes, thus improving the oral health status. The aim of the present cross-sectional study was to investigate the oral health status among 12- and 15-year-old school children in Lebanon, to achieve a better understanding of the oral health situation and help to plan new policies and programmes.

In the present study, a WHO pathfinder approach was chosen, which involved investigation of the 6 governorates of Lebanon to ensure the participation of all the population subgroups that may have different disease status and need dental care. Two ages were chosen (12 and 15 years), allowing a time trend analysis of the evaluated diseases. This is useful in a population for which there are no previous data, as is the case in Lebanon. In light of the coverage of urban, suburban and rural areas and public and private schools, the study results may be considered relevant at a national level. The sample age groups were chosen and data were collected based on WHO methodology and criteria so the results can be compared with international studies. We used a global recording system that provided reliable data on the occurrence of oral diseases. Dental caries and periodontal diseases were evaluated because they are the most prevalent oral diseases and serve as a basis for oral health prevention programmes. The present survey provided a valid overview of the oral health status of Lebanese school children. WHO-recommended interexaminer reliability in clinical examination was obtained but examination under daylight may have underestimated the real situation and was a limitation of this study. The present study is the first national survey to assess the oral health status of Lebanese school children.

According to WHO criteria, high levels of dental caries were found for both ages in our study. A mean (SD) DMFT score of 4.90 (3.484) and 5.51 (3.589) was found for children aged 12 and 15 years, respectively. It is noteworthy that dental caries could be even more frequent because interdental caries could not be detected during clinical examination using the DMFT index. A time trend analysis has highlighted the absence of any effective improvement plan since 1996 when the situation was alarming (DMFT scores of 5 for age 12 years and 7.7 for age 15 years) (9). Our results are in agreement with the latest study conducted in Lebanon that showed DMFT

scores of 3.42 and 5.44 for children aged 12 and 15 years, respectively (8). Remarkably, the obtained DMFT scores were even higher than those found in children of the same age in nearby Arab countries (14–19) and other developing countries (20–22). This indicates that dental caries prevalence and severity among Lebanese children are alarming and that preventive and oral health promotion must be implemented.

CPI is a well-established method for assessing the periodontal status because of its simplicity, reproducibility and international uniformity. Consistent with the results obtained in 1996, the present national study showed prevalence of periodontal disease of 96.4% and 96.8% among children aged 12 and 15 years, respectively. Only 3.4% of children exhibited healthy periodontal status (CPI = 0), 44% showed gingival bleeding (CPI = 1), 50.5% exhibited calculus with bleeding (CPI = 2), whereas only 2% exhibited shallow periodontal pockets (CPI = 3). The prevalence of periodontal disease among Lebanese school children (96.6%) appeared to be among the highest in the Eastern Mediterranean Region (18,23).

This is believed to be the first study to address the risk factors associated with dental caries and periodontal disease prevalence among the Lebanese population. Higher DMFT score, gingival bleeding, calculus and shallow pockets were observed in children aged 15 years compared with 12 years. This result is not surprising since caries and periodontal disease are cumulative processes that increase with age. Additionally, we observed that DMFT scores as well as gingival bleeding and calculus levels were significantly higher among students attending public than private schools. This could be attributed to the low level of oral health practices among public school students. DMFT scores were significantly higher in rural than urban regions. This findings could be explained by the poor oral hygiene habits in rural regions and the greater opportunities for urban students to attend dental care services. Calculus and shallow pockets levels were significantly higher among smokers. Smoking is known to exert a significant effect on periodontal status, which might predispose individuals to the development of periodontal disease (24). Calculus and shallow pockets were more frequent in girls than in boys. The association between sex and periodontal disease prevalence is still debatable. Several studies have reported higher prevalence in male than in female participants (25), but others have indicated no significant effect of sex on periodontal health (26,27).

Conclusion

This study showed that dental caries and periodontal disease levels in school children aged 12 and 15 years in Lebanon are extremely high, thus highlighting a critical oral health issue. School-based preventive campaigns encouraging a healthier lifestyle for those at high risk and regular dental follow-up should be supported and conducted for Lebanese school children.

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Competing interests: None declared.

État de santé bucco-dentaire des écoliers libanais âgés de 12 à 15 ans

Résumé

Contexte : Les études portant sur l'état de santé bucco-dentaire des écoliers libanais sont rares.

Objectifs : Évaluer l'état de santé bucco-dentaire des enfants d'âge scolaire libanais et fournir des données épidémiologiques pour la planification et l'évaluation des programmes de soins de santé bucco-dentaire.

Méthodes : Nous avons sélectionné 7902 écoliers âgés de 12 à 15 ans dans les six gouvernorats du Liban, en utilisant une méthode d'échantillonnage probabiliste à plusieurs degrés. Les données ont été obtenues au moyen de questionnaires structurés auto-administrés et d'examens cliniques (méthodologie et critères de l'Organisation mondiale de la Santé). Les caries dentaires ont été enregistrées en utilisant l'indice CAO (dents cariées, absentes ou obturées). Le statut parodontal a été évalué à l'aide de l'indice communautaire parodontal (CPI).

Résultats : Le nombre moyen (écart type) de dents cariées, manquantes et obturées était de 3,01 (2,927), 0,05 (0,245) et 2,14 (2,071), respectivement, et le score CAO moyen était de 5,20 (3,549). Dans l'ensemble de la population testée, la prévalence des caries était de 89,5 % et seuls 10,5 % des enfants n'avaient aucune carie. L'âge, l'emplacement géographique et le secteur scolaire constituaient les facteurs de risque les plus importants pour la prévalence des caries. Une parodontopathie (score CPI > 0) a été observée chez 7633 participants (96,6 %). Contrairement aux poches parodontales peu profondes qui montraient une faible prévalence, le tartre était l'affection parodontale la plus fréquemment détectée dans les deux âges (50,9 % à 12 ans et 50,2 % à 15 ans). L'âge, le sexe, le secteur scolaire et le tabagisme étaient fortement associés à la survenue de parodontopathies.

Conclusion : Des campagnes de santé publique à des fins préventives et réparatrices sont fortement recommandées pour améliorer l'état de santé bucco-dentaire chez les écoliers

libanais.

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