MEDICINA 53 (2017) 253–258

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.elsevier.com/locate/medici

Original Research Article

Periodontal status in 18-year-old Lithuanian adolescents: An epidemiological study

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ARTICLE INFO

Article history:
Received 27 April 2016
Received in revised form
25 January 2017
Accepted 12 June 2017
Available online 23 June 2017

Keywords:
Periodontal Screening and Recording index
Silness-Löe plaque index
Adolescent
Oral health

ABSTRACT

Objective: The aim of this study was to investigate the periodontal and oral hygiene status of 18-year-old Lithuanian adolescents.

Materials and methods: Cross-sectional data were collected by a multistage sampling approach that was used to draw a representative sample of 1063 adolescents attending schools. In total, 20 schools from the alphabetical list of educational institutions in Lithuania agreed to participate. Periodontal status was evaluated using the Periodontal Screening and Recording (PSR) index. The oral hygiene status was assessed using the Silness-Löe plaque index.

Results: The analysis of the PSR index showed that 77.1% of the study population exhibited gum bleeding on probing, had supragingival and/or subgingival calculus, and shallow pockets. Analysis of the composition of the PSR index revealed that in children whose parents had low education levels (18.6%), gum bleeding was more common than in those whose parents had medium education levels (9.5%) ($P < 0.05$). Our data showed that in 40.0% of the study participants, oral hygiene status was satisfactory, with a statistically significant difference between boys (46.9%) and girls (35.3%) ($P < 0.001$).

Conclusions: The results of our study showed that the periodontal and oral hygiene status of 18-year-old Lithuanian population could be characterized as poor. In total, 77.1% of the study participants were found to have periodontal conditions such as gum bleeding, dental calculus, and shallow pockets. The anterior teeth of the mandible were most frequently affected.

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http://dx.doi.org/10.1016/j.medici.2017.06.002

1. Introduction

Chronic diseases have the most important risk to human health [1]. Dental caries and periodontal diseases are common chronic oral diseases causing multiple health issues [2,3]. Oral health promotion programs traditionally focus on dental caries. However, in Lithuania periodontal diseases are widespread too, but still there is a lack of comprehensive population studies in this field, especially of those which are suitable for comparison with epidemiological studies conducted in other countries [4–6]. Few epidemiological studies carried out in Lithuania showed that the prevalence of periodontal disease among 12-year-old children was 47.4% [4], while among 17–30-year olds, 97.2% [6]. Periodontal conditions such as gum bleeding on probing, supragingival or subgingival calculus, and periodontal pockets of 4–5 mm depth were documented in 29.2%, 18.2%, and 0.3% of 12-year-old Lithuanian children, respectively [4].

In adolescence the prevalence of periodontal diseases may increase due to physiological hormonal changes [7] as well as contributing environmental and behavioral factors [8]. Clinical signs of early stages of periodontal diseases are reversible if adequate oral hygiene is implemented and maintained [9]. However, there is part of the population in which early periodontal conditions might develop into severe and progressive stages in the future [10]. The 5-year longitudinal study carried out in the United Kingdom reported that the loss of periodontal tissue attachment increased from 3.0% in 14-year olds to 37.0% in 16-year olds and 77.0% in 19-year olds [11].

The diagnosis of periodontal diseases and evaluation of risk factors in adolescence are both crucial because the initial forms of these diseases may progress to severe or even irreversible complications. High-risk individuals could be included in special prevention or treatment programs, recognizing that the initial forms of periodontal diseases are simply and effectively prevented and treated.

The aim of the study was to evaluate the periodontal and oral hygiene status among 18-year-old Lithuanian adolescents.

2. Materials and methods

2.1. Study population

This cross-sectional study on the periodontal and oral hygiene status was carried out among 18-year-old Lithuanian adolescents in 2014. The method of multistage cluster sampling was used. Lithuania is divided into 10 counties. In the first stage, each county was divided into smaller urban and rural administrative units (clusters). During the second stage, in each cluster, schools (sub-clusters) from the alphabetic list of all the schools based on the data from the education management information system of the Centre of Information Technologies in Education were selected (the first and the last school from the list were chosen). If the selected school refused to participate, the following one from the list was approached. In total, 27 schools were approached in the study, and 20 of them were enrolled in the final study sample. In the third stage, 3rd gymnasium classes (a block) were selected. One hundred adolescents from each selected block were asked to complete the questionnaire about their birth date, gender, oral hygiene skills, and parental education level. Totally, 2000 adolescents from all over the country were interviewed. The study was voluntary; the inclusion criteria were age of 17.5–18.5 years and agreement to be enrolled in the study by signing written informed consent. A total of 1063 adolescents met the inclusion criteria. Adolescents were informed about the fact that they could withdraw from the study at any time. The flow chart of the study sample is presented in Fig. 1.

2.2. Final sample

The sample size was calculated using the Paniott's formula with the error of 0.05% based on the 18-year-old population in 2012, which was 37 036 according to the Lithuanian Department of Statistics (Statistics Lithuania). By using this formula, it was determined that not less than 396 18-year-old adolescents had to be included in the study. Permission to examine the subjects was granted by the Kaunas Regional Biomedical Research Ethics Committee on 27 November 2012 (No. BE-2-47). The aims and procedures of the study were explained to the children's parents, and written informed consent was obtained from each adolescent.

2.3. Clinical examination and interview

Participants were asked about their parent's education level, which was classified into low education (unfinished or graduated secondary school), medium education (higher education – college) and high education (higher education – university).

Periodontal examinations were performed under standardized conditions using a comfortable chair with a head support and portable dental units equipped with a halogen light source, compressed air, and suction device. All periodontal status measurements were performed by four researchers (J.Z., K.S., N.B., and V.A.) who were trained and calibrated. Training and calibration was performed on 35 18-year-old subjects with some extent of periodontal conditions who were not included in the final sample. The examiners were trained to assess indicators of the periodontal conditions such as gingival bleeding, supragingival and/or subgingival calculus, and periodontal pockets. The process included theoretical activities with discussions regarding the diagnostic criteria for all conditions. Inter-examiner agreement among the examiners and intra-examiner agreement was evaluated and was shown to be good with the kappa value ranging from 0.83 to 0.87. The examination was carried out using portable equipment. The severity and prevalence of periodontal conditions as well as the oral hygiene status of the subjects were evaluated.

Periodontal status was evaluated using the Periodontal Screening and Recording (PSR) index [12]. The examination involved gentle insertion of the periodontal probe into the gingival sulcus of each tooth until light resistance was met and then ''walking'' the probe around the tooth circumference. After examination of each tooth in the sextant, only the highest code obtained was recorded and only one score was recorded for each sextant.

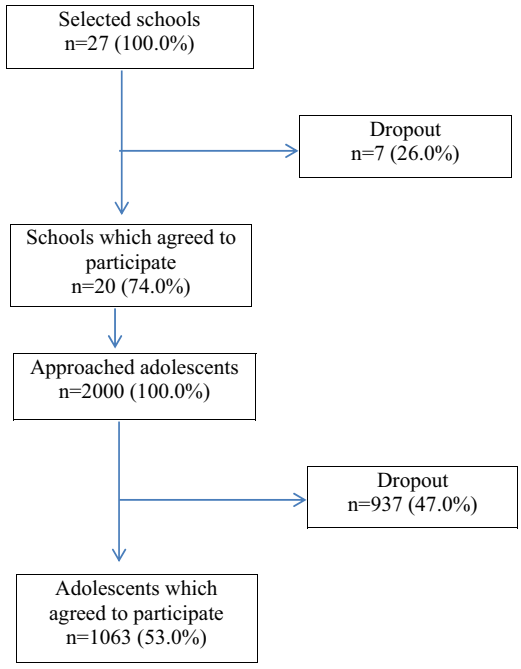

Fig. 1 – Flow chart of the study sample.

The PSR codes were based on the following clinical definitions: Code 0, probing elicits no bleeding, gingival tissues are healthy; Code 1, bleeding on probing (BOP), plaque, but no calculus; Code 2, the probe encounters supragingival and subgingival calculus, bleeding; Code 3, probing depths between 3.5 and 5.5 mm; Code 4, probing depths of 6 mm and more (bleeding, plaque, calculus). Need for treatment was classified as follows: Code 0, preventive treatment; Code 1, professional plaque removal, oral hygiene instruction; Code 2, calculus removal and scaling, oral hygiene instruction; Code 3, calculus removal and scaling, oral hygiene instruction, complete periodontal exam and radiographs; Code 4, calculus removal and scaling, oral hygiene instruction, complex therapy [12].

Oral hygiene status was assessed by using the Silness-Löe plaque index, which is based on recording soft debris on the teeth. Each of the four tooth surfaces (buccal, lingual, mesial, and distal) is given a score of 0–3. The scores from the four areas of the tooth are added up and divided by four to determine the plaque index for the tooth with the following scores and criteria: Grade 0, no plaque (excellence); Grade 1, thin plaque layer at the gingival margin, only detectable by scraping with a probe (good); Grade 2, moderate layer of plaque along the gingival margin; interdental spaces free, but plaque is visible to the naked eye (satisfactory); Grade 3, abundant plaque along the gingival margin; interdental spaces filled with plaque (poor) [12].

2.4. *Statistical analysis*

Statistical data analysis was conducted using SPSS 22.0 software (Chicago Illinois, USA). The Kolmogorov–Smirnov test was employed in the investigation of hypotheses about the normality of parameter distribution. Continuous data (PSR and Silness-Löe plaque indices) of two independent samples were compared with the Mann–Whitney *U* test. Relationship was assessed by using Spearmen correlation. The independence of categorical data was evaluated with help of the chi-square (χ^2) test. The difference was considered to be statistically significant when the level of significance *P* was less than 0.05.

3. Results

A total of 1063 18-year-old adolescents (427 boys and 636 girls) were enrolled in the study. Analysis of the PSR index showed that 77.1% of the study participants had gum bleeding on probing, supragingival and/or subgingival calculus, and shallow pockets.

A significantly greater percentage of girls than boys had healthy periodontal tissue (26.2% and 18.1%, respectively; $P < 0.01$) (Table 1). The difference in the prevalence of index code 1 between girls and boys was also statistically significant (12.2% vs. 19.8%, $P < 0.01$) (Table 1).

A more detailed analysis of the PSR index prevalence revealed that in adolescents whose parents had low education levels, bleeding on probing (Code 1) was more common (18.6%) than in those whose parents had medium education levels (9.5%) ($P = 0.02$) (Table 1).

Evaluation of sextant showed that milder periodontal conditions were detected in the maxillary sextants than in the mandibular sextants ($P < 0.001$). More advanced periodontal

Table 1 – The prevalence of PSR index by gender, place of residence, and parental education level among 18-year-old adolescents.

Codes of the PSR index	Gender		Place of residence		Parental education level		
	Boys	Girls	Urban	Rural	Low	Medium	High
0	72 (18.1)[a]	156 (26.2)[a]	161 (23.4)	67 (21.8)	63 (21.6)	65 (23.8)	74 (25.1)
1	79 (19.8)[b]	73 (12.2)[b]	107 (15.6)	45 (14.7)	54 (18.6)[c]	26 (9.5)[c]	39 (13.2)
2	245 (61.6)	367 (61.6)	417 (60.7)	195 (63.5)	174 (59.8)	182 (66.7)	182 (61.7)
3	2 (0.5)	0	2 (0.3)	0	0	0	0
	$\chi^2 = 18.81$, $df = 3$, $P < 0.001$; [a,b]$P < 0.01$		$\chi^2 = 1.524$, $df = 3$, $P = 0.677$		$\chi^2 = 10.301$, $df = 4$, $P = 0.036$; [c]$P = 0.002$		

Values are number (percentage).
The same superscript letters indicate a statistically significant difference in the prevalence of PSR index codes.

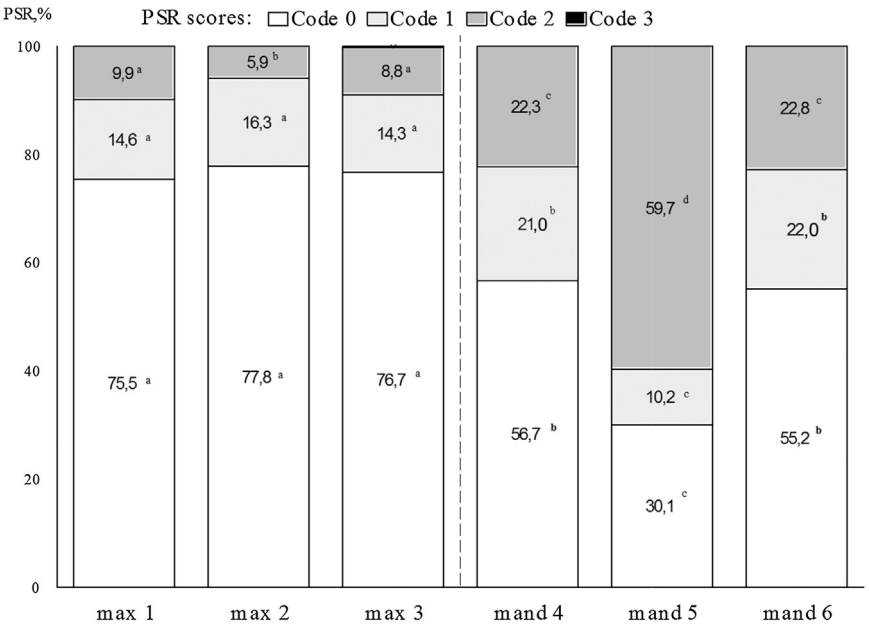

Fig. 2 – Distribution of the PSR index regarding its prevalence in sextants among 18-year-old adolescents.
χ^2 = 1266.661, *df* = 15, *P* < 0.001.
The same superscript letter denotes a subset of ''sextant'' categories whose proportions do not differ significantly from each other at the *P* < 0.05 level.
Max, maxillary; mand, mandibular.

conditions were detected in the anterior sextant of the mandible (Fig. 2).

The mean PSR values (mean [SD]) were statistically significantly higher (0.65 [0.57]) in boys than girls (0.55 [0.51]) ($P < 0.001$). The analysis of the data in urban and rural areas showed that statistically significant differences only existed between boys (0.67 [0.57]) and girls (0.56 [0.51]) living in urban areas ($P < 0.05$), whereas no significant differences were found between male and female rural residents.

The subjects' oral hygiene status was evaluated by analyzing dental plaque, one of the major risk factors for periodontal diseases. We found that oral hygiene status was only satisfactory in approximately 40.0% of subjects; poor oral hygiene was detected more frequently in boys (46.9%) than in girls (35.3%), and this difference was statistically significant ($P < 0.001$).

A comparison of the mean Silness-Löe plague index (oral hygiene status) between the genders showed statistically significantly higher index values in boys than girls (1.28 [0.67] and 1.09 [0.6], respectively; $P < 0.001$).

The application of the non-parametric Spearman correlation showed a direct significant correlation between mean PSR and mean Silness-Löe plaque indices ($r = 0.6$, $P < 0.001$).

4. Discussion

Our study is the first to evaluate the periodontal and oral hygiene status among 18-year-old residents of Lithuania. Unfortunately, routinely available and comparable epidemiological data on periodontal diseases are scarce and particularly unreliable and, moreover, are absent from several European countries [13]. Our results show that only 22.9% of the study population had healthy periodontal tissues. Analysis of data from other countries revealed a considerably better situation in 18-year-old Albanians – more than one-half of the subjects had healthy periodontal tissues [14]. Mizutani et al. in 2012 examined young Japanese individuals aged 18 and 19 years and found that 14.7% of the subjects had healthy periodontal tissues [15]. An evaluation of the periodontal status of 18-year-old Iranians revealed that 8.0% of subjects had healthy periodontal tissues [16]. Because of the lack of data on the periodontal status of 18-year-old adolescents, we had to compare our results with those obtained in similar age groups: healthy periodontal tissues were observed in 17.0% of 15–19 year-old Americans, 34.0% of Finnish, 45.0% of French, and 7.0% of German adolescents in this age group [17]. However, comparison of all these data with the findings of our study is difficult because study designs, outcome measurements, populations, and sample sizes were different as well as all studies were conducted in different years. These existing worldwide differences are based on the economic and political situation, governmental influence on health-related programs, and oral hygiene habits in each country; however, some tendencies in the prevalence of periodontal diseases and conditions still could be observed.

The results of our study show that according to the PSR index, 77.1% of the study participants had gum bleeding, supragingival or subgingival calculus, and shallow pockets. Data from other countries have shown that 44.0% of Albanians

and 74.0% of Japanese aged 18 years exhibited such signs, while 81.0% of Armenians and 72.0% of Croatians aged 15–19 years had gum bleeding and supragingival or subgingival calculus [14,15,17]. Studies conducted in France and Israel yielded better results in this age group: 54.0% and 60.0% of the 15–19-year-old population, respectively, had gum bleeding and supragingival or subgingival calculus [17]. These findings show that periodontal conditions are prevalent in other countries also.

For this reason, early diagnosis, treatment, and prevention among adolescents are of utmost importance to prevent severe periodontal disease at an older age [18]. Gum bleeding and dental calculus influence both the current condition and the progression of periodontal disease [19]. The presence of these factors significantly affects the initial stage of periodontal tissue destruction – the loss of periodontal connective tissue attachment [20]. A study by Skudutyte et al. in 2001 reported that 47.0% of Lithuanians aged 35–44 years had signs of severe periodontitis [5]. Our results and the fact that age is an important factor in the development and progression of periodontal diseases indicate that it is important to begin treatment of the initial forms of this disease as early as possible, to apply professional oral hygiene procedures, and to teach the patients appropriate personal oral hygiene skills [18].

The results of our study show that advanced periodontal conditions were much more common in the mandible, especially in the area of the anterior teeth. Similar results were obtained in a study conducted by Laganà et al. [14], in which dental calculus in the anterior sextant was diagnosed nearly twice as frequently as in the posterior ones. This suggests the influence of anatomical–morphological peculiarities of the mouth [21]. Our study also shows that the most abundant plaque was detected in the site of the anterior teeth in the mandible, which may also be an influencing factor.

According to the data in our study, PSR values in boys were statistically significantly higher than those in girls. The same trends were observed in studies [22–25] in which females had lower levels of dental plaque, calculus, and gingival inflammation, compared with males. This situation might have been influenced by the fact that women are more thorough concerning their oral hygiene, have better knowledge about oral health, and more frequently practice a healthy lifestyle [22,23,26].

Personal hygiene is important for saving healthy oral tissues in children. Dental plaque is the main risk factor for the development of periodontal diseases [27]. The findings of our study show that up to 40.0% of the subjects had poor oral hygiene. Poor oral hygiene was detected more frequently in boys than girls, and this difference was statistically significant. This suggests that poor oral hygiene was probably the reason for the higher prevalence of the first sign of periodontal disease – gum bleeding – among boys. Other authors have also observed the influence of poor oral hygiene (such as irregular or incorrect tooth brushing or failure to use interdental care items) on the development of periodontal disease [18,23,24].

Recently, many countries, especially developed countries, have witnessed the trends in the reducing prevalence and severity of dental caries, which is associated with fluoridated toothpastes, regular tooth brushing, and preventive programs [5,22,26]. However, periodontal diseases remain widespread and tend to increase in severity with age. The reason for this could be that educational interventions lead only to a short-term improvement in periodontal health and oral hygiene, and a broader psychosocial theoretical behavioral approach should be sought instead of that currently employed in dentistry – and health promotion programs should be developed on the basis of that approach [26].

In Lithuania, children up to the age of 18 years receive medical care free of charge; most commonly, they are treated at polyclinics or family clinics, and a small proportion chooses the private sector. Unfortunately, owing to time limitations or other circumstances, only the consequences of diseases are treated, while the identification of the risk factors of the disease or the application of preventive measures receives insufficient attention. Another issue is insufficient employment of oral hygienists in Lithuania compared with Nordic countries in which oral hygiene attracts significant attention. Oral hygienists in these countries are highly involved in working with children and adolescents (for instance, in Norway and Finland, this work takes up 75.0% and 43.0% of clinical work time in the public sector, respectively) [28]. Parents' and children's insufficient knowledge about the effect of poor oral hygiene on disease development may also play a significant role, as may the parents' inappropriate approach or care. Studies have shown that relatively stable models of health-related habits are created during adolescence and are difficult to modify during adulthood [29].

Some limitations should be considered while interpreting the findings of our study. A cross-sectional design does not allow observing the trends in the prevalence of periodontal conditions in this age group over the time. Distribution of the participants by gender (427 boys and 636 girls) show us inadequacy, but this could be explained by that fact that the study sample was drawn from schools, and according to the Lithuanian Department of Statistics (Statistics Lithuania), the proportion of girls attending schools is by 10% greater than that of boys [30]. However, to our knowledge, this is the first study on periodontal conditions enrolling 18-year-old Lithuanian adolescents, and the sample size in this study is relatively large. Our findings could complement Lithuanian epidemiological data on periodontal conditions and add additional information that would be useful in the future when planning oral health prevention programs.

5. Conclusions

The results of our study show that the periodontal status of 18-year-old adolescents in Lithuania is poor. In total, 77.1% of the study participants were found to have periodontal conditions such as gum bleeding, dental calculus, and shallow pockets. The anterior teeth of the mandible were most frequently affected.

Conflict of interest

The authors declare no conflict of interest.

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