

Lulëjeta Ferizi¹, Venera Bimbashi^{2*}, Jeta Kelmendi³

Dental Caries Prevalence and Oral Health Status among 15-Year- Old Adolescents in Kosovo

Prevalencija zubnog karijesa i stanje oralnoga zdravlja petnaestogodišnjih adolescenata na Kosovu

- ¹ Department of Pediatric and Preventive Dentistry, Dental School, Faculty of Medicine, University of Prishtina and University Dentistry Clinical Center of Kosovo
Zavod za pedijatrijsku i preventivnu stomatologiju – Stomatološki i Medicinski fakultet Sveučilišta u Prištini i Sveučilišni stomatološki klinički centar Kosova
- ² Department of Prosthodontics, Dental School, Faculty of Medicine, University of Prishtina and University Dentistry Clinical Center of Kosovo
Zavod za protetiku – Stomatološki i Medicinski fakultet Sveučilišta u Prištini i Sveučilišni stomatološki klinički centar Kosova
- ³ Department of Orthodontics, Dental School, Faculty of Medicine, University of Prishtina, Kosovo
Zavod za ortodontiju – Stomatološko i Medicinski fakultet Sveučilišta u Prištini, Kosovo

Abstract

Caries has a harmful impact on oral and general health and is a major public health problem among children and adolescents. The objective of present study was to investigate into dental caries, oral hygiene, the frequency of brushing habits and dental visits among 15-year-old adolescents. **Material and methods:** This cross-sectional study was carried out on a random sample of 323 15-year-old adolescents in different schools and municipalities of Kosovo. Oral clinical examination and self-administered questionnaire were used to obtain information about dental caries and oral health practices. Oral hygiene and caries status in permanent dentition was assessed through the DMFT index and Oral Hygiene Index - Simplified (OHI-S). The level of statistical significance was set at $p < 0.05$. **Results:** The total mean of the DMFT index was 3.21 ± 2.193 , while component D of the DMFT index dominated in both genders, with slightly higher values in boys compared to girls (2.15 ± 2.092 , and 1.91 ± 1.919). The mean OHI-S index of adolescents aged 15 was found to be 1.945 ± 3.926 . Over 50% of schoolchildren brush their teeth only once per day and they have visited the dentist only when it was necessary. Irregular tooth-brushing, dental visits and poor oral hygiene index were significantly related to dental caries. **Conclusion:** The results of the study showed poor oral health status among 15-year-old adolescents in Kosovo. There is an emergent need for caries-prevention programs focusing on oral health and healthy habits.

Received: January 9, 2022

Accepted: March 1, 2022

Address for correspondence

Venera Bimbashi
Department of Prosthodontics
University of Prishtina
Dental School, Faculty of Medicine
University Dentistry Clinical Center of Kosovo
Rrethi i Spitalit p.n. 10000 Prishtina,
Republic of Kosovo
Phone: +383 44166600
vbimbashi@gmail.com
<https://orcid.org/0000-0002-7212-4972>

MeSH terms: Dental Caries; Oral Hygiene Index; Tooth brushing; Patient Acceptance of Health Care; Adolescents

Introduction

Dental caries is characterized as a pandemic disease which is still widespread around the world among people, particularly in lower socio-economic classes (1). The multifactorial etiology of dental caries includes tooth, bacteria in dental plaque, such as *Streptococcus mutans*, and a carbohydrate diet. As a consequence of these three main factors, and many other factors, the demineralization of the enamel will be caused, and after a while the dentin will also be affected (2).

Generally, there are main differences in dental caries between developed and developing countries. In developed countries, a decrease in dental caries was reported as a result of advanced preventive programs applied to promote oral health and access to dental health services (3, 4). However, it

Uvod

Zubni karijes jedna je od pandemijskih bolesti koja je još uvijek itekako raširena među ljudima diljem svijeta, posebice u nižim socioekonomskim slojevima (1). Višestruka etiologija zubnoga karijesa obuhvaća zub, mikroorganizme u zubnom plaku, primjerice, *Streptococcus mutans*, i prehranu bogatu ugljikohidratima. Kao posljedica tih triju glavnih čimbenika, ali i mnogih drugih, pojavljuje se demineralizacija cakline, a nakon nekog vremena i dentina (2).

Općenito, velike su razlike u prevalenciji karijesa između razvijenih zemalja i onih u razvoju. U razvijenim zemljama zabilježen je pad prevalencije karijesa zbog naprednih preventivnih programa, programa promidžbe oralnoga zdravlja i pristupa stomatološkim zdravstvenim uslugama (3, 4). No

is disturbing that in developing countries there is still a risk of increasing dental caries due to unbalanced diet, uncontrolled sugar consumption, lack of application of fluoridation methods and inadequate oral health care (5).

The group of children aged between 6 and 12 and adolescents are considered to be groups that are most affected by caries, therefore the WHO considers them target age groups to investigate into the level of caries in different countries around the world (6). Children and adolescents are giving preferences to sweetened beverages and soft drinks, which are rich in carbohydrates, between meals. In addition, they have numerous engagements during the day. Consequently, the aforementioned are considered high hazards for dental caries, thus making the problem of caries prevalence even more significant at those ages (7). Oral health goals framed jointly by the World Health Organization (WHO) and the FDI-World Dental Federation for the year 2000 included a 50% reduction of dental caries for 6-year-olds, an average DMFT index of no more than 3.0 for 12-year-olds, and 85% of the population up to the age of 18 should have all of their teeth (8).

Oral health as an important part of overall health enables a person to eat, talk, and to be socialized. Subsequently, this affects the overall well-being of each individual (9). School age is a period of great influence on the development of a child's personality, as well as on the behaviors related to oral health. Hence, it is important to teach children and adolescents good oral health behaviors because they will carry those valuable lessons with them as they get older (10). Particularly, it is important to possess knowledge about dietary habits, brushing habits and dental visits, which will enable individuals to have good oral health (9, 11-13). The results of numerous studies showed that most children brush their teeth once a day (14, 15). A number of dental caries studies have been conducted in Kosovo, and the results have shown that the rate of dental caries is quite high (15-17).

Within this context, this study aimed to evaluate the prevalence of caries and to analyze related risk factors among 15-year-old adolescents from different cities of Kosovo.

Material and methods

This study involved an epidemiological cross-sectional data collected in several schools in different cities of Kosovo during 2017/2018. Accordingly, the adolescents from every public school from cities of Kosovo had an equivalent occasion of participating in the study. An electronic invitation was delivered to each school of Kosovo to examine the adolescents, and afterward, the first of them who positively replied to the invitation were selected for further research. The sample and the classroom were randomly selected in each public school. The sample included 323 adolescents of both genders. The study was approved by the Ministry of Education, Science, and Technology of the Republic of Kosovo (approval number: 3752/2016). Firstly, each parent was informed by the school board prior to data collection and then a consent form was obtained for each adolescent examined.

Two working teams were formed to conduct the research; each team consisted of a pediatric dentist and three students

zabrinjava činjenica da u zemljama u razvoju još postoji rizik od povećanja prevalencije zubnoga karijesa zbog neuravnotežene prehrane, nekontrolirane konzumacije šećera, neprijemljivanja metoda fluoridacije i neredovite skrbi za oralno zdravlje (5).

Djeca u dobi od 6 do 12 godina te adolescenti smatraju se skupinama koje su najzahvaćenije karijesom pa ih zato SZO smatra ciljanim dobnim skupinama za praćenje razine karijesa u različitim zemljama diljem svijeta (6). Djeca i adolescenti između obroka konzumiraju zaslađene napitke i bezalkoholna pića bogata ugljikohidratima. To se smatra visokorizičnim ponašanjem za ekspresiju zubnoga karijesa, što prevalenciju karijesa u toj dobi čini još važnijom (7). Ciljeve za poboljšanje oralnoga zdravlja koje su 2000. godine zajednički postavili Svjetska zdravstvena organizacija (WHO) i FDI – World Dental Federation, uključivali su smanjenje karijesa za šestogodišnjake za 50 %, prosječan DMFT indeks ne veći od 3,0 za dvanaestogodišnjake i da 85 % stanovništva do 18 godina treba imati sve zube (8).

Oralno zdravlje, kao važan dio cjelokupnoga zdravlja, omogućuje osobi da jede, razgovara i da se socijalizira. U skladu s tim, to utječe na opću dobrobit svakog pojedinca (9). Školska dob razdoblje je snažnoga razvoja djetetove osobnosti i ima velik utjecaj na ponašanja vezana za oralno zdravlje. Zato je važno da djeca i adolescenti nauče kako održavati oralno zdravlje s obzirom na to da navike koje se ranije steknu imaju veći dugoročni utjecaj (10). Posebno je važno informirati o prehrambenim navikama, te koliko je važna navika četkanja zuba i odlasci stomatologu (9, 11 – 13). Rezultati mnogobrojnih istraživanja pokazali su da većina djece četka zube jedanput na dan (14, 15). Na Kosovu su provedena mnoga istraživanja o prevalenciji karijesa i rezultati su pokazali da je stopa karijesa prilično visoka (15 – 17).

U tom kontekstu je cilj ovoga istraživanja bio procijeniti prevalenciju karijesa i analizirati povezane čimbenike rizika među petnaestogodišnjim adolescentima iz različitih gradova na Kosovu.

Materijali i metode

U ovo istraživanje uključeni su epidemiološki presječni podatci prikupljeni u nekoliko škola u različitim gradovima na Kosovu tijekom 2017./2018. U skladu s tim, adolescenti iz svih javnih škola iz kosovskih gradova mogli su sudjelovati u istraživanju. Svakoj školi u zemlji poslan je elektronički poziv za pregled adolescenata, nakon čega su oni koji su prvi pozitivno odgovorili odabrani za daljnje istraživanje. Kalkulirali smo slučajni uzorak i učionica je nasumično odabrana iz svake javne škole. Uzorak je obuhvatio 323 adolescenta obaju spolova. Istraživanje je odobrilo Ministarstvo obrazovanja, znanosti i tehnologije Republike Kosovo (broj odobrenja: 3752/2016). Najprije je, prije prikupljanja podataka, školski odbor obavijestio svakog roditelja, a zatim je za svakoga ispitnoga adolescenta dobiven pristanak.

Osnovana su dva radna tima za provedbu istraživanja – svaki su činili dječji stomatolog i tri studenta završne godine studija stomatologije. Dječji stomatolog s kliničkim i epi-

in the final year of dentistry studies. A pediatric dentist with clinical and epidemiological experience has trained the examiners to use the methodology according to the criteria of the World Health Organization (WHO), 1997, for epidemiological studies (18). In recording caries severity, the Decayed, Missing and Filled Tooth (DMFT) index was used for 15-year-old adolescents. Oral hygiene status was assessed by using evaluation criteria described by Green and Vermillion, 1964, for use of the Simplified Oral Hygiene Index (OHI-S Index) (19). Dental caries and the OHI-S Index were diagnosed under natural light, using the following dental instruments: a mirror and a probe. Dental examinations were performed at school during daytime hours by two calibrated examiners (Kappa=0.96-intraexaminer and 0.94-interexaminer). The clinical findings were recorded by a student assistant.

The questionnaire was administered to all 15-year-old adolescents attending grade 9 who were willing to take part in the study, in which demographic records (gender, habitation, simplified oral hygiene and dental status), the frequency of dental visits and the frequency of brushing habits were included. A questionnaire was pretested by adolescents' one day before the examination to assess whether the questionnaire was understandable to the adolescents. Afterwards, the teachers supported the researchers and did not intercede in the administration of the structured questionnaire. Adolescents were asked about the frequency of brushing their teeth during the day (the main options were: twice or once a day and rare), whereas regarding dental visits the options were once in 6 months, once in year, and the third given option was only when necessary. The exclusion criteria applied in the current study were as follows: those who rejected to participate in the study, those undergoing orthodontic treatment, and healthy compromised adolescents. The inclusion criteria were: 15-year-old adolescents (both genders), who were present on the day of the examination. At the end of the examination, the parents of the adolescents who were in need of dental care were given a recommendation. Subsequently, a lecture about oral health and using the correct oral hygiene technique of toothbrushing was held in every classroom.

Statistical Analysis

Data were entered using SPSS package 19 for Windows (SPSS Inc., Chicago, Illinois, USA) software and descriptive data were obtained, included frequencies and means. The variances concerning means were established using the student t-test. The Spearman's rank correlation (Spearman's rho) was used to test the association between frequency of brushing habits, dental visits, OHI-S index and DMFT index. A level of $p < 0.05$ was considered statistically significant.

Results

The characteristics of the adolescents by gender and the mean of DMFT index are presented in Table 1. The standard deviation and the mean for DMFT were found (3.21 ± 2.193). Furthermore, the component D was more dominant among boys compared to girls (2.15 ± 2.092 and 1.91 ± 1.919), fol-

demioškim iskustvom osposobio je ispitivače za korištenje metodologije prema kriterijima Svjetske zdravstvene organizacije (SZO, 1997.) za epidemiološka istraživanja (18). Za bilježenje progresije karijesa među petnaestogodišnjim adolescentima korišten je DMFT indeks (*Decayed, Missing, Filled Tooth*). Stanje oralne higijene procijenjeno je prema kriterijima koje su opisali Green i Vermillion (1964.) za pojednostavljeni indeks oralne higijene (OHI-S indeks) (19). Zubi karijes i OHI-S indeks dijagnosticirani su pod prirodnim svjetlom, s pomoću stomatoloških instrumenata, zrcala i sonde. Stomatološke preglede u školi obavljala su dva kalibrirana ispitivača (Kappa = 0,96 – intraispitivač i 0,94 – interispitivač). Kliničke nalaze bilježio je student asistent.

Upitnik je podijeljen svim petnaestogodišnjim adolescentima u 9. razredima koji su bili voljni sudjelovati u istraživanju, a bili su uključeni demografski podatci (spol, mjesto stanovanja, pojednostavljeni status oralne higijene i stanje zuba), učestalost posjeta stomatologu i učestalost čišćenja zuba. Dan prije pregleda adolescenata upitnik je testiran kako bi se procijenilo je li im razumljiv. Nakon toga učitelji su podržali istraživače i nisu posredovali u administraciji strukturiranoga upitnika. Adolescenti su odgovarali na pitanja o učestalosti čišćenja zuba tijekom dana (glavne opcije bile su dva puta ili jedanput da dan i rijetko), te o posjetima stomatologu – mogućnosti su bile jedanput u šest mjeseci i jedanput na godinu, a treća je bila samo kad je potrebno. Kriteriji za isključivanje primijenjeni u ovom istraživanju bili su odbijanje sudjelovanja u istraživanju, aktivna ortodontska terapija i zdravstveno kompromitirani adolescenti. Kriteriji za uključivanje bili su petnaestogodišnjaci (oba spola) nazočni u školi na dan ispitivanja. Na kraju pregleda roditeljima adolescenata kojima je bila potrebna stomatološka skrb dana je preporuka. Nadalje, u svakoj učionici održano je predavanje o oralnome zdravlju i pravilnoj tehnici čišćenja zuba.

Statistička analiza

Podatci su uneseni s pomoću paketa SPSS 19 za Windows (SPSS Inc., Chicago, Illinois, SAD) i dobiveni su deskriptivni podatci, uključene frekvencije i srednje vrijednosti. Odstupanja u odnosu prema srednjim vrijednostima utvrđene su Studentovim t-testom. Spearmanova korelacija rangova (Spearmanov rho) korištena je za testiranje povezanosti između učestalosti čišćenja, posjeta stomatologu, OHI-S indeksa i DMFT indeksa. Razina $p < 0,05$ smatrala se statistički značajnom.

Rezultati

Karakteristike adolescenata prema spolu i srednje vrijednosti DMFT indeksa nalaze se u tablici 1. Standardna devijacija i srednja vrijednost za DMFT iznosila je $3,21 \pm 2,193$. Nadalje, komponenta D bila je dominantnija među dječacima nego djevojčicama ($2,15 \pm 2,092$ i $1,91 \pm 1,919$), a slije-

Table 1 Mean and standard deviation for DMFT components, DMFT free and OHI-S index based on gender
Tablica 1. Srednja vrijednost i standardna devijacija za DMFT komponente, bez DMFT-a i OHI-S indeks na temelju spola

Gender • Spol	N	D	M	F	DMFT	DMFT free • Bez DMFT-a	OHI-S
		Mean ± SD • Srednja vrijednost ± SD	Mean ± SD • Srednja vrijednost ± SD	Mean ± SD • Srednja vrijednost ± SD	Mean ± SD • Srednja vrijednost ± SD	Mean ± SD • Srednja vrijednost ± SD	Mean ± SD • Srednja vrijednost ± SD
Girls • Djevojčice	162	1.91±1.919	0.36±0.665	0.86±1.372	3.10±2.190	0.15±0.356	1.957±0.424
Boys • Dječaci	161	2.15±2.092	0.34±0.672	0.86±1.344	3.33±2.196	0.11±0.308	1.932±0.359
Overall • Ukupno	323	2.03±2.008	0.35±0.667	0.86±1.356	3.21±2.193	0.13±0.333	1.945±0.393

Table 2 Brushing habits per day and frequency of dental visits
Tablica 2. Dnevne navike četkanja i učestalost posjeta stomatologu

Gender • Spol	Brushing habits per day • Učestalost četkanja zubi u danu			Dental visits • Posjeti stomatologu		
	Frequency • Učestalost	N	%	Frequency • Učestalost	N	%
Girls • Djevojčice	Twice • Dva puta	4	2.5	Once in 6 months • Jedanput u 6 mjeseci	46	28.4
	Once • Jedanput	86	53.1	Once in year • Jedanput na godinu	20	12.3
	Rare • Rijetko	72	44.4	Only when necessary • Samo prema potrebi	96	59.3
Boys • Dječaci	Twice • Dva puta	3	1.9	Once in 6 months • Jedanput u 6 mjeseci	45	28.0
	Once • Jedanput	126	78.3	Once in year • Jedanput na godinu	24	14.9
	Rare • Rijetko	32	19.9	Only when necessary • Samo prema potrebi	92	57.1
Overall • Ukupno	Twice • Dva puta	7	2.2	Once in 6 months • Jedanput u 6 mjeseci	91	28.2
	Once • Jedanput	212	65.6	Once in year • Jedanput na godinu	44	13.6
	Rare • Rijetko	104	32.2	Only when necessary • Samo prema potrebi	188	58.2

Table 3 Conditional univariate logistic regression analysis of oral hygiene, dental visits, DMFT index, and OHI-S
Tablica 3. Uvjetna univarijantna logistička regresijska analiza oralne higijene, posjeta stomatologu, DMFT indeksa i OHI-S

Correlations • Korelacije						
		Brushing habits per day • Učestalost četkanja u danu	Dental visits • Učestalost posjeta stomatologu	DMFT	OHI-S	
Spearman's rho • Spearmanov rho	Brushing habits per day • Učestalost četkanja u danu	Correlation Coefficient	1.000	-.193**	.044	.005
		Sig. (2-tailed)	.	.000	.426	.928
		N	323	323	323	323
	Dental visits • Učestalost posjeta stomatologu	Correlation Coefficient	-.193**	1.000	.096	.119*
		Sig. (2-tailed)	.000	.	.085	.032
		N	323	323	323	323
	DMFT	Correlation Coefficient	.044	.096	1.000	.663**
		Sig. (2-tailed)	.426	.085	.	.000
		N	323	323	323	323
	OHI-S	Correlation Coefficient	.005	.119*	.663**	1.000
		Sig. (2-tailed)	.928	.032	.000	.
		N	323	323	323	323

** . Correlation is significant at the 0.01 level (2-tailed) • Korelacija je značajna na razini 0,01

* . Correlation is significant at the 0.05 level (2-tailed) • Korelacija je značajna na razini 0,05

lowed by F-component and M-component which tended to be comparable throughout both genders.

On the other hand, the overall OHI-S index was 1.945, slightly higher in girls (1.957) compared to boys (1.932) (Table 1).

The distributions of the frequencies related to brushing habits and dental visits are presented in table 2. According to the results obtained in this study, 65.6 % of adolescents of both genders brush their teeth once a day. The percentage of adolescents who visited the dentist only when necessary exceeded 50% amongst both genders.

de F-komponenta i M-komponenta koje su bile usporedive za oba spola.

S druge strane, ukupni indeks OHI-S iznosio je 1,945 i bio je nešto viši kod djevojčica (1,957) u usporedbi s dječacima (1,932) (tablica 1.).

Distribucija učestalosti vezana za navike četkanja i posjete stomatologu prikazana je u tablici 2. S obzirom na rezultat od 65,6 %, oba spola najčešće četkaju zube jedanput na dan. Postotak adolescenata koji su odlazili kod stomatologa samo prema potrebi premašio je 50 % među oba spola.

By using the Spearman's rank correlation, it was obvious that there was a significant association concerning the frequencies of brushing habits, dental visits, OHI-S index and DMFT index (Table 3).

Discussion

Oral health is not only a necessary component of overall health, but it also affects the quality of life. Dental caries is the most common oral problem affecting more than 2 billion people worldwide. According to the WHO report, dental caries is a chronic disease ranked as fourth most expensive medical treatment (20-22).

This study offered a broad overview and evidence on the level of DMFT index, OHI-S index, and behaviors related to dental brushing habits and dental visits among 15-year-old adolescents in Kosovo. This is worthwhile in a population without previous data presented on dental caries among 15-year-old adolescents, as is the case of Kosovo. The present study showed high scores of the DMFT index among the examined adolescents, and the DMF-index was totally dominated by the D component. The results concerning gender showed that boys had higher DMFT index values compared to girls. Those results are corresponding with previous reports (23-25), but the values were higher than those in studies conducted by others (26-32), and considerably lower than reported in other studies (33-37). Such high values can be explained by the deficiency of national preventive programs, the shortage of dentists in schools, as well as the lack of preventive and educational measures in Kosovo.

Oral Hygiene Index (OHI-S) has been accepted as useful index for assessment of dental health education in public school systems, and it is also considered an indication of oral hygiene (19). The level of oral hygiene in our study is considered to be low, and similar values were also found in previous study conducted in our country in different group ages (17). Also, contrary to our results, other studies observed better oral hygiene, which was also correlated with a lower level of dental caries (32, 38, 39). Good oral hygiene practice is the most significant feature determining the general oral health of an individual. The most common aids used for maintaining oral hygiene were toothbrushes and toothpaste. They decrease plaque accumulation within which oral bacteria survive to produce acid that increases the risk of caries. Attaining good oral hygiene practice early in life by the child does improve upright practices later throughout life (38). The current study showed that most of adolescents in Kosovo brush their teeth only once a day, which caused an increase in the level of caries and plaque index. This may be related to improper toothbrushing time, inefficient brushing technique or both. There is a discrepancy between our results and the results of previous studies where adolescents of the same age brushed their teeth more than once a day (30, 37, 40). Moreover, in disagreement with our study, females, as compared to males, had significantly higher-performing oral hygiene habits such as tooth brushing twice a day and they brushed their teeth after their last meal before bedtime (37). This is not surprising since adolescents are not examined yearly by a den-

Korištenjem Spearmanove korelacije rangova ustanovljena je značajna povezanost u učestalosti četkanja zuba, posjeta stomatologu, OHI-S indeksa i DMFT indeksa (tablica 3.).

Rasprava

Oralno zdravlje nije samo nužna komponenta cjelokupnog zdravlja, nego utječe i na kvalitetu života. Zubni karijes najrašireniji je oralni zdravstveni problem koji pogađa više od 2 milijarde ljudi diljem svijeta. Prema izvješću SZO-a, karijes je kronična bolest i nalazi se četvrtom mjestu najskupljih liječenja (20 – 22).

Ovo istraživanje dalo je pregled i dokaze o razini DMFT indeksa, OHI-S indeksa i navikama četkanja zuba i posjeta stomatologu među petnaestogodišnjim adolescentima na Kosovu. To su vrijedni podatci o populaciji bez prethodnih podataka o zubnom karijesu među petnaestogodišnjacima. U ovom istraživanju istaknuta je visoka razina DMFT indeksa među ispitanim adolescentima, pri čemu je prevladavajuća vrijednost bila komponenta D. Rezultati koji se odnose na spol pokazali su da su dječaci imali više vrijednosti DMFT indeksa u usporedbi s djevojčicama. Ti rezultati korespondiraju s prethodnim izvješćima (23 – 25), ali su bili viši u odnosu prema istraživanjima koja su proveli drugi autori (26 – 32) i znatno niži od onih objavljenih u ostalim istraživanjima (33 – 37). Tako visoke vrijednosti mogu se objasniti nedostatkom nacionalnih preventivnih programa, nedostatkom stomatologa u školama te nedostatkom preventivnih i obrazovnih mjera na Kosovu.

Indeks oralne higijene (OHI-S) prihvaćen je kao koristan za procjenu edukacije o zdravlju zuba u javnim školskim sustavima i također se smatra pokazateljem oralne higijene (19). Razina oralne higijene u našem istraživanju smatra se lošom, a približne vrijednosti ustanovljene su i u prethodnom istraživanju provedenom u našoj zemlji u različitim dobnim skupinama (17). Za razliku od naših rezultata, u drugim istraživanjima zabilježena je bolja oralna higijena, što je također bilo u korelaciji s nižom razinom prevalencije zubnog karijesa (32, 38, 39). Dobra praksa u oralnoj higijeni najznačajnije je obilježje koje određuje opće oralno zdravlje pojedinca. Najčešća pomagala za njezino održavanje su četkice i paste za zube. Njima se smanjuje nakupljanje plaka u kojemu preživljavaju oralni mikroorganizmi kako bi proizveli kiselinu koja povećava rizik od pojave karijesa. Postizanje dobre oralne higijene u ranoj dobi djeteta pospješuje ispravnu praksu kasnije tijekom života (38). Ovo je istraživanje pokazalo da većina adolescenata zube četka samo jedanput na dan, što utječe i na visoku razinu prevalencije karijesa i indeksa plaka. To može biti povezano s neadekvatnim vremenom četkanja, neučinkovitom tehnikom ili jednim i drugim. Rezultati našeg istraživanja različiti su od rezultata dobivenih u drugim istraživanjima u kojima adolescenti iste dobi zube četkaju više od jedanput na dan (30, 37, 40). Štoviše, u suprotnosti s našim istraživanjem, žene su u usporedbi s muškarcima imale znatno bolje navike kad je riječ o oralnoj higijeni, kao što je četkanje zuba dva puta na dan i četkanje zuba poslije posljednjeg obroka prije spavanja (37). To nije neočekivano jer adolescente go-

tal team and they are not educated about the need of brushing their teeth regularly and, also, about the benefits of using toothpastes containing fluoride. Regular twice-daily toothbrushing with fluoridated toothpaste is a recommended practice for good oral health.

In addition, the adolescents participating in current study reported that they visited the dentist only when it was necessary, in which case a substantial positive correlation was established amongst the overall oral hygiene status, dental caries, and the frequency of brushing habits and the frequency of dental visits. Conversely, a number of other studies reported contradictory results regarding the frequency of dental visits: it was higher than once a year (30, 37). Preventive dental visits are highly recommended, but in Kosovo there seems to be still a long way to go since dental visits are generally associated with a worse caries status. Thus, these aspects should focus on more targeted and effective oral health promotion initiatives in the future. A greater understanding of these risk factors is indispensable in order to identify the population's oral health status, thus learning how to improve it. Understanding risk factors can contribute to development of more effective dental public health policies.

This study has some strengths and limitations. The main strength of the current study includes the assessment of oral status according to WHO procedures and criteria for epidemiological studies so that our results obtained in Kosovo can be compared with those from different countries in the future. Strengths also include necessary steps and pilot test for intra-examiner and inter-examiner agreement, so that obtained results are consistent and reliable. Few limitations of the study must be well-thought-out. In Kosovo, adolescents from higher socioeconomic backgrounds are likely to be enrolled in private schools and we did not make the comparison regarding oral health between public and private adolescents, nor between urban and rural residents. Consequently, the existing relationships with other risk factors heretofore described as cariogenic diet, socio-economic status, family income, parents' age, educational level and occupation, and anxiety about dental treatment, were not analyzed (30,33,37,38). These circumstances are interesting due to the possible interaction with the variables described in this study.

However, the results of this study suggest a possible association of the existing low level of oral health knowledge in the study population with high level of dental caries, which was published in previous research.

Conclusions

In conclusion, the prevalence of dental caries in Kosovo schoolchildren was high, which is consistent with the results obtained in previous research. However, the prevalence of caries is still much higher than in most European countries. Restorative and preventive public health promotions are exceedingly suggested to improve oral health status among Kosovo adolescents. Caries prevention measures should be taken thoroughly and on a huge scale, primarily in the form of fluoride management (brushing with fluoride gel, tablets), application of dental sealants in order to avoid extensive re-

dišnje ne pregledava stomatološki tim i nisu educirani o potrebi četkanja zuba i prednostima korištenja zubne paste s fluorom. Četkanje zuba dva puta na dan fluoridiranom pastom preporučena je praksa za dobro oralno zdravlje.

Uz to, adolescenti su u ovom istraživanju izvijestili da su posjećivali stomatologa samo kada je to bilo potrebno te je ustanovljena značajna pozitivna korelacija između statusa oralne higijene, broja karijesa, učestalosti četkanja zuba i učestalosti posjeta stomatologu. Suprotno tomu, u mnogim drugim istraživanjima dobiveni su drukčiji rezultati – učestalost posjeta stomatologu bila je češća od jedanput na godinu (30, 37). Preventivni posjeti stomatologu preporučuju se, ali na Kosovu je, čini se, još dug put do toga jer su odlasci stomatologu općenito povezani s lošijim statusom karijesa. Zato bi ti aspekti trebali biti usmjereni na pokretanje učinkovitih inicijativa za promicanje oralnoga zdravlja u budućnosti. Razumijevanje tih čimbenika rizika prijeko je potrebno da bi se identificiralo stanje oralnoga zdravlja među stanovništvom i kako bi se ono moglo poboljšati, te potaknuo razvoj učinkovite politike javnoga zdravlja u stomatologiji.

Ovo istraživanje ima i neke prednosti i neka ograničenja. Glavna prednost jest procjena oralnoga statusa prema procedurama SZO-a i kriterijima za epidemiološka istraživanja, tako da se naši rezultati na Kosovu u budućnosti mogu usporediti s onima iz različitih zemalja. Druga prednost su potrebne mjere i pilot-test za podudaranje unutar ispitivača i između njih, tako da su dobiveni rezultati dosljedni i pouzdani. Treba istaknuti i nekoliko ograničenja u istraživanju. Na Kosovu se adolescenti iz viših socioekonomskih sredina vjerojatno upisuju u privatne škole, tako da nismo uspoređivali oralno zdravlje među adolescentima iz javnih i privatnih škola, ni između urbanih i ruralnih sredina. Slijedom toga, nisu analizirani postojeći odnosi s drugim čimbenicima rizika koji su dosad bili opisivani kao kariogena prehrana, socioekonomski status, prihodi obitelji, dob roditelja, razina obrazovanja i zanimanja te anksioznost prema stomatološkom liječenju (30, 33, 37, 38). Te su okolnosti zanimljive zbog moguće interakcije s varijablama opisanim u ovom istraživanju.

Međutim, u istraživanju se upozorava na moguću povezanost između niske razine znanja o oralnome zdravlju u ispitivanoj populaciji i visoke prevalencije karijesa, što je objavljeno u prethodnim istraživanjima.

Zaključak

Zaključno, prevalencija i opseg zubnoga karijesa kod kosovske školske djece bio je vrlo sličan u prošlim istraživanjima i još uvijek je mnogo veći nego u većini europskih zemalja. Preporučuju se promocije preventivnih javnozdravstvenih mjera radi poboljšanja statusa oralnoga zdravlja među kosovskim adolescentima. Prevenciji karijesa potrebno je temeljito se posvetiti, ponajprije kad je riječ o fluoridaciji (četkanje fluoridnim gelom, tablete), pečačenju zuba i edukaciji o oralnoj higijeni. Nadalje, četkanje koncentriranim fluoridnim gelom mora se uključiti u osnovne škole.

storative procedures in the future, and education for healthier oral hygiene. Furthermore, comprehensive tooth brushing with concentrated fluoride gel is recommended for caries prevention in primary and permanent teeth of children in elementary schools.

Data availability

The datasets used and analyses throughout the present study are obtainable from the corresponding author upon reasonable request.

Conflict of interest

The authors of this article declare that they do not have any competing interests concerning the publication of this paper.

Funding

The authors have not received any specific financial support for this study. The present study was self-funded by the investigators.

Acknowledgment

The authors gratefully acknowledge the help of all adolescent participants who provided records and dedicated their time to make this study possible. We would also like to thank all school workers for being helpful and patient. Finally, appreciations also go to the Ministry of Education, Science, and Technology of the Republic of Kosovo, which enabled us to conduct this research for the first time in Kosovo.

Author's contribution: L. F., V. B. - conducted writing of the manuscript, interpretation of the data, the literature review and bibliographic search. L. F., V. B. - performed the statistical analysis, and preparation of the tables; J. K. - contributed to dental examination and questionnaire collection, was involved in drafting and reviewing of the manuscript. The manuscript has been read and approved by all named authors.

Dostupnost podataka

Korišteni podatci i analize iz ovog istraživanja mogu se na zahtjev dobiti od autora.

Sukob interesa

Autori nisu bili u sukobu interesa.

Financiranje

Autori nisu dobili nikakva posebna financijska sredstva za ovo istraživanje – financirali su ga sami.

Zahvala

Autori zahvaljuju svim sudionicima adolescentima koji su uložili svoje vrijeme kako bi omogućili ovo istraživanje. Velika hvala i svima zaposlenima u školama na pomoći i strpljenju. Na kraju zahvaljuju i Ministarstvu obrazovanja, znanosti i tehnologije koje je omogućilo da se takvo istraživanje prvi put organizira na Kosovu.

Doprinos autora: L. F., V. B. – pisanje rukopisa, interpretacija podataka, pregled literature i bibliografsko pretraživanje; L. F., V. B. – statistička analiza, izrada tablica; J. K. – stomatološki pregledi i prikupljanje upitnika, pisanje i recenzija rukopisa. Svi su autori pročitali i odobrili konačni rukopis.

Sažetak

Svrha rada: Karijes štetno utječe na oralno i opće zdravlje te je velik javnozdravstveni problem među djecom i adolescentima. Cilj ovog istraživanja bio je kod petnaestogodišnjih adolescenata istražiti prevalenciju karijesa, status oralne higijene, navike četkanja zuba i učestalost posjeta stomatologu. **Materijali i metode:** Ovo presječno istraživanje provedeno je na slučajnom uzorku od 323 adolescenata u dobi od 15 godina u različitim kosovskim školama i općinama. Obavljeni su klinički oralni pregledi te su ispitanici samostalno ispunjavali upitnike da bi se dobile informacije o zubnom karijesu i oralnome zdravlju. Stanje oralne higijene i karijesa u trajnoj denticiji procijenjeno je na temelju DMFT indeksa i indeksa oralne higijene – pojednostavljeno OHI-S-a. Razina statističke značajnosti postavljena je na $p < 0,05$. **Rezultati:** Ukupna srednja vrijednost DMFT indeksa iznosila je $3,21 \pm 2,193$, pri čemu je komponenta D dominirala u oba spola, s nešto višim vrijednostima kod dječaka negoli kod djevojčica ($2,15 \pm 2,092$ i $1,91 \pm 1,919$). Prosječni indeks OHI-S adolescenata u dobi od 15 godina iznosio je $1,945 \pm 3,926$. Više od 50 % školske djece zube četka samo jedanput na dan i posjećuju stomatologa samo kada je potrebno. Neredovito četkanje zuba, rijetki posjeti stomatologu i loš indeks oralne higijene znatno su povezani s prevalencijom karijesa. **Zaključak:** Svi analizirani podatci pokazali su da je među petnaestogodišnjim adolescentima na Kosovu stanje oralnoga zdravlja loše. Potrebna je hitna primjena valjanih programa za zaustavljanje karijesa koji se usredotočuju na oralno zdravlje i zdrave navike.

Zaprimljen: 9. siječnja 2022.

Prihvaćen: 1. ožujka 2022.

Adresa za dopisivanje

Venera Bimbashi
Department of Prosthodontics
University of Prishtina
Dental School, Faculty of Medicine
University Dentistry Clinical Center of Kosovo
Rrethi i Spitalit p.n. 10 000 Prishtina,
Republic of Kosovo
tel: +383 44166600
vbimbashi@gmail.com
orcid.org/0000-0002-7212-4972

MeSH pojmovi: zubni karijes; indeks oralne higijene; četkanje zuba; prihvaćanje zdravstvene skrbi; adolescenti

References

- Lee Y. Diagnosis and Prevention Strategies for Dental Caries. *J Lifestyle Med.* 2013 Sep;3(2):107-9.
- Colak H, Dülgergil CT, Dalli M, Hamidi MM. Early childhood caries update: A review of causes, diagnoses, and treatments. *J Nat Sci Biol Med.* 2013 Jan;4(1):29-38.
- Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of untreated caries: a systematic review and meta-regression. *J Dent Res.* 2015 May;94(5):650-8.
- Edelstein BL. The dental caries pandemic and disparities problem. *BMC Oral Health.* 2006 Jun;6 Suppl 1(Suppl 1):S2.
- Elamin A, Garemo M, Mulder A. Determinants of dental caries in children in the Middle East and North Africa region: a systematic review based on literature published from 2000 to 2019. *BMC Oral Health.* 2021 May;21(1):237.
- Petersen PE, Baez RJ, Ogawa H. Global application of oral disease prevention and health promotion as measured 10 years after the 2007 World Health Assembly statement on oral health. *Community Dent Oral Epidemiol.* 2020 Aug;48(4):338-48.
- Punitha VC, Amudhan A, Sivaprakasam P, Rathana Prabhu V. Role of dietary habits and diet in caries occurrence and severity among urban adolescent school children. *J Pharm Bioallied Sci.* 2015 Apr;7(Suppl 1):S296-300.
- Petersen PE. Challenges to improvement of oral health in the 21st century--the approach of the WHO Global Oral Health Programme. *Int Dent J.* 2004 Dec;54(6 Suppl 1):329-43.
- Carneiro L, Kabulwa M, Makyao M, Mrosso G, Choum R. Oral health knowledge and practices of secondary school students, tanga, Tanzania. *Int J Dent.* 2011;2011:806258.
- Shailee F, Girish MS, Kapil RS, Nidhi P. Oral health status and treatment needs among 12- and 15-year-old government and private school children in Shimla city, Himachal Pradesh, India. *J Int Soc Prev Community Dent.* 2013 Jan;3(1):44-50.
- Kasila K, Poskiparta M, Kettunen T, Pietilä I. Oral health counseling in changing schoolchildren's oral hygiene habits: a qualitative study. *Community Dent Oral Epidemiol.* 2006 Dec;34(6):419-28.
- Gill P, Stewart K, Chetcuti D, Chestnutt IG. Children's understanding of and motivations for tooth brushing: a qualitative study. *Int J Dent Hyg.* 2011 Feb;9(1):79-86.
- Alhareky M, Nazir MA. Dental Visits and Predictors of Regular Attendance among Female Schoolchildren in Dammam, Saudi Arabia. *Clin Cosmet Investig Dent.* 2021 Mar;13:97-104.
- Maes L, Vereecken C, Vanobbergen J, Honkala S. Tooth brushing and social characteristics of families in 32 countries. *Int Dent J.* 2006 Jun;56(3):159-67.
- Ferizi L, Bimbashi V, Kelmendi J, Olloni T. Oral Health Status Among 12-Year-Old Schoolchildren in Kosovo. *Pesq Bras Odont Clin Integ.* 2020 Jul; 20.
- Ferizi L, Dragidella F, Staka G, Bimbashi V, Mrasori S. Oral health status related to social behaviors among 6-11 year old schoolchildren in Kosovo. *Acta Stomatol Croat.* 2017 Jun;51(2):122-32.
- Shabani LF, Begzati A, Dragidella F, Hoxha VH, Cakolli VH, Bruçi B. The correlation between DMFT and OHI-S index among 10-15 years old children in Kosova. *Inter J Dent Oral Health.* 2015;5:2002-5.
- World Health Organization. *Oral Health Surveys - Basic Methods.* 4th ed. Geneva: World Health Organization; 1997.
- Greene JC, Vermillion JR. The simplified oral hygiene index. *J Am Dent Assoc.* 1964;68:7-13.
- Petersen PE. Global policy for improvement of oral health in the 21st century--implications to oral health research of World Health Assembly 2007, World Health Organization. *Community Dent Oral Epidemiol.* 2009 Feb;37(1):1-8.
- Marcenes W, Kassebaum NJ, Bernabé E, Flaxman A, Naghavi M, Lopez A, et al. Global burden of oral conditions in 1990-2010: a systematic analysis. *J Dent Res.* 2013 Jul;92(7):592-7.
- Petersen PE. World Health Organization global policy for improvement of oral health--World Health Assembly 2007. *Int Dent J.* 2008 Jun;58(3):115-21.
- Oulis CJ, Tsinidou K, Vadiakas G, Mamai-Homata E, Polychronopoulou A, Athanasouli T. Caries prevalence of 5, 12 and 15-year-old Greek children: a national pathfinder survey. *Community Dent Health.* 2012 Mar;29(1):29-32.
- Ambarkova V, Panova O. Dental caries experience among 15-years old children in the southeast region of the Republic of Macedonia. *Oral Health Dental Manag.* 2015;14(6):353-60.
- Vesna A, Batra M, Stevanovic M, Jankulovska M, Shah AF, Ishrat A, et al. Dental Caries experience among 12 year old school children from Macedonia and India. *J Dent Prob Sol.* 2015 Nov;2(3):44-7.
- Gökalp SG, Doğan BG, Tekçiçek MT, Berberoğlu A, Unlüer S. National survey of oral health status of children and adults in Turkey. *Community Dent Health.* 2010 Mar;27(1):12-7.
- Kundu H, Patthi B, Singla A, Jankiram C, Jain S, Singh K. Dental Caries Scenario Among 5, 12 and 15-Year-old Children in India- A Retrospective Analysis. *J Clin Diagn Res.* 2015 Jul;9(7):ZE01-5.
- Bajomo AS, Rudolph MJ, Ogunbodede EO. Dental caries in six, 12 and 15 year old Venda children in South Africa. *East Afr Med J.* 2004 May;81(5):236-43.
- Skinner J, Johnson G, Phelan C, Blinkhorn A. Dental caries in 14- and 15-year-olds in New South Wales, Australia. *BMC Public Health.* 2013 Nov;13:1060.
- Obregón-Rodríguez N, Fernández-Riveiro P, Piñeiro-Lamas M, Smyth-Chamosa E, Montes-Martínez A, Suárez-Cunqueiro MM. Prevalence and caries-related risk factors in schoolchildren of 12- and 15-year-old: a cross-sectional study. *BMC Oral Health.* 2019 Jun;19(1):120.
- Okeigbemen SA. The prevalence of dental caries among 12 to 15-year-old school children in Nigeria: report of a local survey and campaign. *Oral Health Prev Dent.* 2004 Jan;2(1):27-31.
- Soumya SG, Shashibhushan KK, Pradeep MC, Babaji P, Reddy VR. Evaluation of Oral Health Status among 5-15-Year-old School Children in Shimoga City, Karnataka, India: A Cross-sectional Study. *J Clin Diagn Res.* 2017 Jul;11(7):ZC42.
- Lešić S, Dukić W, Kriste ZŠ, Tomićić V, Kadić S. Caries prevalence among schoolchildren in urban and rural Croatia. *Cent Eur J Public Health.* 2019 Sep;27(3):256-62.
- Mahfouz M, Abu Esaid A. Dental Caries Prevalence among 12-15 Year Old Palestinian Children. *Int Sch Res Notices.* 2014 Oct;2014:785404.
- Marković N, Arslanagic Muratbegovic A, Kobaslija S, Bajric E, Selimovic-Dragas M, Huseinbegovic A. Caries prevalence of children and adolescents in Bosnia and Herzegovina. *Acta Med Acad.* 2013 Nov;42(2):108-16.
- Malak CA, Chakar C, Romanos A, Rachidi S. Oral health status of 12-and 15-year-old Lebanese school children. *East Med Health J.* 2021 Jun;27(6).
- Milona M, Janiszewska-Olszowska J, Szmidi M, Kłoda K, Olszowska T. Oral Health Related Behaviors in Relation to DMFT Indexes of Teenagers in an Urban Area of North-West Poland-Dental Caries Is Still a Common Problem. *Int J Environ Res Public Health.* 2021 Feb;18(5):2333.
- Ndanu TA, Aryeetey R, Sackeyfio J, Otoo G, Lartey A. Oral hygiene practices and caries prevalence among 9-15 years old Ghanaian School children. *J Nutr Health Sci.* 2015;2(1):104.
- Jaiswal D, Kalra P, Hiremath S, Singh AK, Pani P, Kumar N. Evaluation of Oral Hygiene Status among 12-14-Year-Old School Children. *J Pharm Bioallied Sci.* 2021 Jun;13(Suppl 1):S112-5.
- Thornton-Evans G, Junger ML, Lin M, Wei L, Espinoza L, Beltran-Aguilar E. Use of Toothpaste and Toothbrushing Patterns Among Children and Adolescents - United States, 2013-2016. *MMWR Morb Mortal Wkly Rep.* 2019 Feb;68(4):87-90.