

## KARIJES RIZIK PROFIL DECE PREDŠKOLSKOG UZRASTA GRADA NIŠA

### CARIES RISK PROFILE OF PRESCHOOL CHILDREN IN THE CITY OF NIŠ

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#### Sažetak

**Uvod:** Primarna prevencija karijesa, od najranijeg detinjstva, ima višestruki značaj. Njena efikasnost je u velikoj meri uslovljena poznavanjem karijes rizik profila subpopulacije u riziku, kao važnog preduslova za razvijanje efikasnih strategija i mera za prevenciju i kontrolu bolesti.

**Cilj:** Izvršiti procenu karijes rizik profila dece predškolskog uzrasta na teritoriji grada Niša, primenom redukovanih kompjuterskih Cariogram® modela.

**Materijal i metode:** Za realizaciju postavljenih ciljeva sprovedena je studija preseka, koja je obuhvatila decu predškolskog uzrasta, starosti od 36 do 48 meseci, koja od rođenja imaju stalno prebivalište na teritoriji grada Niša. Prikupljanje podataka izvršeno je anketiranjem majki i kliničkim pregledom ispitanika. Karijes rizik profil ispitanika izrađen je primenom redukovanih Cariogram® modela.

**Rezultati:** Studijom je obuhvaćeno 276 ispitanika predškolskog uzrasta, prosečne starosti  $41,28 \pm 4,4$  meseci. Najveći procenat ispitanika ima umeren rizik od pojave karijesa, sa, u proseku, 50% šansi da u budućnosti izbegnu pojavu nove karijesne lezije. U procjenjenom karijes rizik profilu dece, najugroženiji sektori su „osetljivost“ (18%) i „bakterije“ (14%), koji se odnose na primenu fluorida kod dece ovog uzrasta i njihovu oralu higijenu.

**Zaključak:** Prema sprovedenoj studiji, važnim karijes rizik faktorima kod dece predškolskog uzrasta, mogu se smatrati nedovoljna izloženost zuba fluoridima i neadekvatana oralna higijena, što treba razmotriti prilikom izbora mera i strategija za prevenciju i kontrolu bolesti. Uz to, neophodno je ponovo razmotriti i vreme dijagnostičkih pregleda, sa ciljem da se prevalencija karijesa i njegove negativne posledice, u ovom uzrastu, svedu na minimum.

**Ključne reči:** karijes rizik, deca, prevencija karijesa

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#### Abstract

**Introduction:** Primary caries prevention from the earliest childhood has multiple significance. Its efficacy is largely conditioned by the knowledge of the caries risk profile of the subpopulation at risk, as an important prerequisite for developing effective strategies and measures for disease prevention and control.

**Aim:** To assess the caries risk profile of preschool children in the City of Niš using a reduced computer Cariogram® model.

**Material and methods:** To realize the set objectives, a cross-sectional study was conducted, which included preschool children, aged 36-48 months, with permanent residence in the City of Niš since birth. The collection of data was done by interviewing mothers, and by the clinical examination of subjects. The caries risk profile of the subjects was performed using a reduced Cariogram® model.

**Results:** The study included 276 subjects of preschool age, mean age  $41.28 \pm 4.40$  months. The highest percentage of subjects has a moderate caries risk, with an average of 50% chance of avoiding a new carious lesion in the future. In the assessed caries risk profile of children, the most vulnerable sectors are "susceptibility" (18%) and "bacteria" (14%), related to the use of fluoride by children of this age and their oral hygiene. The highest percentage of subjects belongs to the moderate caries risk group.

**Conclusion:** According to the conducted study, insufficient exposure of teeth to fluoride and inadequate oral hygiene may be considered significant caries risk factors in preschool children, which should be considered when choosing measures and strategies for disease prevention and control. Also, it is necessary to reconsider the time of diagnostic examinations to reduce the prevalence of caries and its negative consequences at this age to a minimum.

**Key words:** caries risk, children, caries prevention

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## ***Uvod***

Karijes ranog detinjstva definiše se kao prisustvo jednog ili većeg broja karijesnih, ekstrahovanih (zbog karijesa) i plombiranih površina mlečnih zuba kod dece do 71 meseca života, što uključuje i decu predškolskog uzrasta, starosti od 3 do 6 godina<sup>1</sup>. Epidemiološke studije ukazuju na visoku rasprostranjenost karijesa kod dece u predškolskom uzrastu, koja u pojedinim zamljama dostiže čak i 85,5%<sup>2</sup>. Još uvek aktuelni podaci pokazuju da u Republici Srbiji u uzrastu od 3 godine oko 30% dece ima makar jedan karijesni, ekstrahovani ili plombirani (kep) zub, da učestalost karijesa raste sa uzrastom dece i da u uzrastu od 6 godina čak 89% dece ima makar jedan KEP zub<sup>3</sup>. Prema ovim podacima, rasprostranjenost karijesa kod dece Nišavskog okruga je u granicama republičkog proseka, pri čemu u ovom uzrastu svako dete u proseku ima 2,3 karijesni, ekstrahovani i/ili plombirani zub<sup>4</sup>.

U mnogim zemljama širom sveta, uključujući i razvijene zemlje, karijes još uvek predstavlja veliki socijalni, ekonomski i zdravstveni problem<sup>5</sup>. U predškolskom uzrastu, karijes je vodeći uzrok oralnog bola i gubitka zuba, sa negativnom reperkusijom na kvalitet života dece, kao i njihovih porodica<sup>6-8</sup>. Osim toga, istraživanja pokazuju da je karijes ranog detinjstva značajan prediktor karijesa kod dece školskog uzrasta<sup>9</sup>. Stoga primarna prevencija ovog oboljenja od najranijeg detinjstva ima višestruki značaj, a njena efikasnost je, osim identifikacije subpopulacije u riziku, uslovljena i poznavanjem karijes rizik faktora i prediktora karijesa, kao bazičnog preduslova razvijanja efikasnih mera i strategija za prevenciju i kontrolu bolesti<sup>10</sup>.

Zbog multikauzalne etiologije karijesa, u oblasti procene karijes rizika veliki broj varijabli može biti od značaja. Utvrđeno je međutim, da nijedna od njih, kao solo faktor, nije pokazala visoku pouzdanost u proceni karijes rizika i da se sigurnost predviđanja pojave budućeg karijesa povećava istovremenom kombinovanom primenom većeg broja varijabli, koje su pokazale značaj u oblasti dijagnostike karijes rizika<sup>11</sup>. Bratthall i saradnici su 1997. godine razvili Cariogram®, kompjuterski program za procenu rizika od nastanka karijesa, čija je efikasnost testirana za različite starosne grupe ispitanika<sup>12</sup>. Ovaj program uzima u obzir interakciju individualno procenjenih faktora rizika za pojavu karijesa, koji su do sada pokazali najveći karijes prediktivni značaj: karijes iskustvo, udružene

## ***Introduction***

Early childhood caries is defined as the presence of one or more decayed, missing (due to caries) and filled surfaces of primary teeth in children up to 71 months of age, which includes preschool children aged 3 to 6 years<sup>1</sup>. Epidemiological studies indicate a high prevalence of caries in preschool children, which in some countries reaches as much as 85.5%<sup>2</sup>. Current data show that about 30% of children aged 3 in the Republic of Serbia has at least one decayed, missing or filled (dmf) tooth, that the incidence of caries increases with age, and that as many as 89% of children aged 6 has at least one decayed, missing or filled tooth<sup>3</sup>. According to these data, the prevalence of caries in children in the Nišava district is within the national average, i.e. each child in this age group has an average of 2.31 decayed, missing, and/or filled teeth<sup>4</sup>.

In many countries around the world, including the developed ones, caries is still a major social, economic, and health problem<sup>5</sup>. At preschool age, caries is the leading cause of oral pain and tooth loss, with a negative repercussion on the quality of life of children and their families<sup>6-8</sup>. Moreover, research has shown that early childhood caries is a significant caries predictor in school-age children<sup>9</sup>. Therefore, primary caries prevention from the earliest childhood has multiple significance, and its efficacy is, in addition to identifying the subpopulation at risk, conditioned by the knowledge of caries risk factors and caries predictors as a basic prerequisite for developing effective measures and strategies for disease prevention and control<sup>10</sup>.

Due to the multicausal etiology of caries, a large number of variables may be important in the field of caries risk assessment. However, it was found that none of them as a solo factor showed high reliability in the assessment of caries risk and that the prediction of future caries increases with the simultaneous combined application of the variables that have shown importance in the diagnosis of caries risk<sup>11</sup>. In 1997, Bratthall et al. developed Cariogram®, a computer program for assessing caries risk, whose efficacy was tested for different subject age groups<sup>12</sup>. This program takes into account the interaction between individually assessed caries risk factors which have shown the greatest caries predictive importance: caries experience, associated diseases, dietary composition and frequency of intake, oral hygiene, fluoride

bolesti, sastav ishrane i frekventnost unosa hrane, stanje oralne higijene, primena fluorida, brzina protoka i puferski kapacitet pljuvačke, salivarni nivo kariogenih mikroorganizama. Međutim, nedavno su Petsi i sar.<sup>13</sup> i Taqi i sar.<sup>14</sup> sugerisali to da primena ovog kompjuterskog programa može biti ograničena u zemljama niskog socio-ekonomskog statusa, jer zahteva upotrebu skupih salivarnih testova. Stoga su ovi autori testirali primenu redukovanih Cariogram® modela, kojim salivarni testovi nisu obuhvaćeni i utvrdili da se uz nešto niži prediktivni značaj može koristiti za efikasnu procenu karijes rizik profila dece.

Uzimajući u obzir značaj poznavanja karijes rizik profila dece predškolskog uzrasta za primarnu prevenciju karijesa, cilj ove studije bio jeda se izvrši procena karijes rizik profila dece predškolskog uzrasta na teritoriji grada Niša, primenom redukovanih kompjuterskog Cariogram® modela.

## Materijal i metode

### Dizajn studije i ispitanici

Za realizaciju postavljenih ciljeva, sprovedena je studija preseka, koja je obuhvatila decu predškolskog uzrasta, starosti od 36 do 48 meseci. Studija je obuhvatila pacijente Službe za preventivnu i dečju stomatologiju Klinike za stomatologiju Medicinskog fakulteta Univerziteta u Nišu (Srbija), kao i pacijente predškolskih ambulanti Službe za preventivnu i dečju stomatologiju Doma zdravlja u Nišu. Roditelji ispitanika dobili su neophodne informacije i dali pisano saglasnost za učešće dece u ovom istraživanju, čiju je realizaciju odobrio Etički komitet Medicinskog fakulteta Univerziteta u Nišu, odlukom broj 12-14532-2/3.

Selekcija ispitanika vršena je prema bazičnim kriterijumima: 1) zdravi ispitanici bez akutnih i hroničnih sistemskih bolesti u ličnoj anamnezi; 2) ispitanici koji su od rođenja sa stalnim prebivalištem na teritoriji grada Niša (prosečna koncentracija fluorida u vodi za piće iznosi  $\leq 0,05$  mg/mL); 3) ispitanici bez dijagnostikovanih strukturalnih defekata na zubima.

Veličina reprezentativnog uzorka određena je na osnovu podataka o populaciji dece uzrasta od 36 do 48 meseci, selektovanoj prema opisanim kriterijmima i prevalenciji karijesa u ovom uzrastu dece, sa nivoom pouzdanosti od 5% i snagom studije 80%. Minimalna izračunata veličina uzorka je 249 ispitanika starosti od 36 do 48 meseci.

use, flow rate and buffer capacity of saliva, and the salivary level of cariogenic microorganisms. However, Petsi et al.<sup>13</sup> and Taqi et al.<sup>14</sup> have recently suggested that the application of this computer program may be limited in countries of low socioeconomic status, as it requires the use of expensive salivary tests. Therefore, these authors tested the application of a reduced Cariogram® model which did not include salivary tests and found that it could be used with somewhat lower predictive significance to effectively assess the caries risk profile of children.

Considering the importance of the knowledge of the caries risk profile of preschool children for primary caries prevention, this study was aimed at assessing the caries risk profile of preschool children in the City of Niš using a reduced computer Cariogram® model.

## Material and methods

### Study design and subjects

To achieve the goals set, a cross-sectional study that included preschool children aged 36-48 months was conducted. The study included patients of the Department of Preventive and Paediatric Dentistry of the Dentistry Clinic of the Faculty of Medicine, the University of Niš, Serbia, as well as patients of preschool clinics of the Department of Preventive and Paediatric Dentistry of the Community Health Centre in Niš. The parents of the subjects received all necessary information and gave written consent to the participation of children in this study, whose implementation was approved by decision number 12-14532-2/3 of the Ethics Committee of the Faculty of Medicine, the University of Niš.

The subjects were selected according to the basic criteria: 1) healthy subjects without acute and chronic systemic diseases in personal history; 2) subjects with permanent residence in the City of Niš since birth (average concentration of fluoride in drinking water is  $\leq 0,05$  mg/mL); 3) subjects without diagnosed structural defects on the teeth.

The size of the representative sample was determined on the basis of data on the population of children aged 36-48 months, selected according to the described criteria and the prevalence of caries in this age group of children with a confidence level of 5% and a study strength of 80%. The minimal calculated sample size was 249 subjects aged 36-48 months.

## **Procena karijes rizik profila ispitanika**

Karijes rizik profil ispitanika procenjen je upotrebljmom Cariogram® modela. Za realizaciju postavljenih ciljeva, u ovoj studiji upotrebljen je redukovani Cariogram® model, koji su opisali Taqi i sar<sup>13</sup>, koji je od mogućih deset obuhvatio sedam varijabli: karijes iskustvo, udružene bolesti, sastav dijete, frekventnost unosa hrane, količina plaka, primena fluorida, klinička procena. Testovi vezani za pljuvačku i bakterijski testovi isključeni su iz programa.

Prikupljanje podataka izvršio je specijalista preventivne i dečje stomatologije. Majke su popunile upitnik, kreiran za potrebe ovog istraživanja, kako bi se, osim bazičnih demografskih podataka, prikupili i podaci o: (1) zdravstvenom stanju ispitanika; (2) frekventnosti unosa ugljenih hidrata i broju dnevnih obroka (procjenjenom na osnovu unosa namirnica u poslednja tri dana); (3) unosu fluorida putem pasti za zube i tabletica.

Klinički pregled ispitanika izvršen je upotrebljom sonde i stomatološkog ogledala. Stanje zdravlja zuba registrovano je "vizuelno-taktilnom" metodom, prema kriterijumima SZO za epidemiološka istraživanja<sup>15</sup> i iskazano Klein-Palmerovim<sup>16</sup> kep (karijes, ekstrakcija, plomba) sistemom, nakon čega su izračunati kip i kips indeksi. Procena stanja oralne higijene obavljena je uprošćenim indeksom oralne higijene po Greene-Vermilionu<sup>17</sup> (OHI-S), za čije određivanje su korišćene površine šest zuba, reprezentativnih za celu denticiju. U mlečnoj denticiji prema Sowolea i sar.<sup>18</sup> za određivanje indeksa korišćene su vestibularne površine 55, 51, 65, 71 zuba, kao i oralne površine 75 i 85 zuba.

Nakon prikupljanja, podaci su ubaćeni u kompjuterski Cariogram® program (dostupan na [www.mah.se/fakulteter-och-omraden/Odontologiska-fakulteten/Avdelning-och-kansli/Cariologi/Cariogram/](http://www.mah.se/fakulteter-och-omraden/Odontologiska-fakulteten/Avdelning-och-kansli/Cariologi/Cariogram/)).

Varijabla „karijes iskustvo“ procenjena je na osnovu podatka o tome da je prosečan kep indeks zuba kod dece predškolskog uzrasta 2,3<sup>4</sup>. Varijabla „klinička procena“ je u skladu sa onom dobijenom pomoću Cariogram® modela, te je za sve ispitanike iznosila<sup>1</sup>.

Na osnovu Cariogramom procenjene šanse da se izbegne pojava nove karijesne lezije, izvršena je procena stepena rizika za nastanak karijesa kod dece u ispitivanoj grupi, prema kriterijumima prikazanim u Tabeli 1.

## **Assessment of caries risk profile of subjects**

The caries risk profile of the subjects was assessed using the Cariogram® model. To achieve the set goals, this study used a reduced Cariogram® model described by Taqi et al.<sup>13</sup>, which included seven variables out of the possible ten: caries experience, associated diseases, composition of diet, frequency of food intake, amount of plaque, fluoride use, and clinical assessment. Saliva and bacterial culture tests were excluded from the program.

The collection of data was done by a specialist in Preventive and Paediatric Dentistry. The mothers filled in a questionnaire, created for this study to collect, in addition to basic demographic data, data on (1) the health status of the subjects; (2) the frequency of carbohydrate intake and the number of daily meals (estimated based on food intake in the last three days); (3) fluoride intake through toothpaste and tablets.

The clinical examination of the subjects was performed using a probe and a dental mirror. The condition of dental health was recorded by the "visual-tactile" method following the WHO criteria for epidemiological research<sup>15</sup>, and expressed by the Klein-Palmer's<sup>16</sup> dmf (decayed, missing, filled) system, after which the dmf and dmfs indices were calculated. The assessment of the oral hygiene condition was performed using a simplified oral hygiene index according to Greene-Vermilion<sup>17</sup> (OHI-S), for whose determination the surfaces of six teeth, the representative for the entire dentition, were used. In primary dentition, according to Sowole et al.<sup>18</sup>, the vestibular surfaces of teeth 55, 51, 65, 71, as well as the oral surfaces of teeth 75 and 85 were used to determine the index.

After collection, the data were entered into the computer Cariogram® program (available at [www.mah.se/fakulteter-och-omraden/Odontologiska-fakulteten/Avdelning-och-kansli/Cariologi/Cariogram/](http://www.mah.se/fakulteter-och-omraden/Odontologiska-fakulteten/Avdelning-och-kansli/Cariologi/Cariogram/)).

The variable "caries experience" was assessed based on the fact that the average DMF index of preschool children was 2.3<sup>4</sup>. The variable "clinical assessment" was in accordance with the one assessed by the Cariogram® model, and for all subjects amounted to<sup>1</sup>.

Based on the Cariogram®-estimated chance of avoiding new carious lesions, caries risk assessment in the studied group of children was performed, following the criteria shown in Table 1.

**Tabela 1.** Kriterijumi za procenu stepena rizika za nastanak karijesa  
**Table 1.** Criteria for assessment of caries risk levels

Stepen rizika za nastanak karijesa Caries risk levels	Kriterijum Criteria
<b>Visok / High</b>	0% – 20% šansi da se izbegne pojava karijesa /chance of avoiding caries in the future
<b>Umeren / Moderate</b>	21% – 80% šansi da se izbegne pojava karijesa /chance of avoiding caries in the future
<b>Nizak / Low</b>	81% – 100% šansi da izbegne pojava karijesa/chance of avoiding caries in the future

### Statistička obrada podataka

Statistička obrada podataka izvršena je u MS Excell programu.

Učestalost karijesa izražena je statističkim indeksima (karijes indeks osoba (kio)), karijes indeks zuba (kiz), indeksima i merama prosečnih vrednosti (karijes indeks prose (kip)), prosečan broj površina zuba zahvaćenih karijesom (kips)), i pokazateljima strukture karijesa (struktura kep-a).

U okviru deskriptivne statistike, numerički podaci prikazani su merama centralne tendencije (srednja vrednost) i merama varijabiliteta (standardna devijacija). Atributivna obeležja predstavljena su u vidu apsolutnih i relativnih brojeva. Dobijeni podaci prikazani su tabelarno i grafički.

### Rezultati

Prema zadatim kriterijumima, selektovano je 276 ispitanika predškolskog uzrasta, starosti od 36 do 48 meseci. Bazične demografske i kliničke karakteristike ispitanika prikazane su u Tabeli 2.

U ispitivanoj grupi dece registrovane su uglavnom umerene vrednosti analiziranih parametara prevalencije karijesa, sa ekstremno nepovoljnom strukturuom KEP-a, u kojoj dominira prisustvo karijesa od čak 99,86% (Tabela 2).

### Statistical data processing

Statistical data processing was done in MS Excel program.

The frequency of caries was expressed by *statistical indices* (Caries Index of Persons (pci), Caries Index of Teeth (tci)), *indices and average values measures* (Caries Index Average (aci), *the average number of tooth surfaces affected by caries* (dmfs)), and *indicators of caries structure* (dmf structure).

Within descriptive statistics, numerical data were presented by measures of central tendency (mean value) and measures of variability (standard deviation). Attributive features were presented in the form of absolute and relative numbers. The obtained data are shown in tables and graphs.

### Results

According to the set criteria, 276 preschool subjects aged 36-48 months, were selected. The basic demographic and clinical characteristics of the subjects are shown in Table 2.

In the studied group of children, the study recorded mostly moderate values of the analysed parameters of caries prevalence, with an extremely unfavourable DMF structure in which the presence of caries dominates with up to 99,86% (Table 2).

**Tabela 2.** Bazične demografske i kliničke karakteristike ispitanika  
**Table 2.** Basic demographic and clinical characteristics of the study group

Karakteristika / Characteristic	Mean ±SD
Starost (meseci) /Age (month)	41,28±4,40
Pol/ Sex	
Muški/ Male (N, %)	148 (51,2%)
Zenski /Female (N, %)	128 (48,8%)
OHI-s index/ indeks oralne higijene/ oral hygiene index	1,06±0,42
kio/pci (karijes indeks osoba/ Caries Index of Persons)	30,77%
kiz/tci (karijes indeks zuba/ Caries Index of Teeth)	10,65%
kip/aci (karijes indeks prosek/ Caries Index Average)	2,13
Struktura kep-a/dmf structure	
k/d (karijes/ decayed )%	99,86%
e/m (ekstrakcija/missing) %	0%
p/f (plomba/filled) %	0,14%

Distribucija analiziranih Cariogram® varijabli prikazana je u Tabeli 3. Najveći broj ispitanika predškolskog uzrasta je bez karijesnih, ekstrahovanih i/ili plombiranih zuba. U pogledu navika u ishrani, 69,23% ispitanika ima 4-5 dnevnih obroka, uz, uglavnom, visoku frekventnost unosa rafinisanih ugljenih hidrata. Visoke vrednosti indeksa oralne higijene registrovane su kod skoro polovine ispitanika. U pogledu upotrebe fluorida, najveći procenat ove grupe ispitanika koristi samo paste za zube, dok 12,69% ispitanika ne koristi fluoride.

The distribution of the analysed Cariogram® variables is shown in Table 3. The largest number of preschool subjects was without decayed, missing, and/or filled teeth. In terms of dietary habits, 69.23% of the subjects had 4-5 daily meals, with a generally high frequency of refined carbohydrates intake. High values of the oral hygiene index were recorded in almost half of the subjects. Regarding the use of fluoride, the largest percentage of this group of subjects used toothpaste only. Twelve point sixty-nine percent of the subjects did not use fluoride.

**Tabela 3.**Cariogram skor i distribucija ispitivanih varijabli u studijskoj grupi  
**Table 3.** Cariogram scores and distribution of variables in the study group

<i>Cariogram varijabla</i>	<i>Uzorak /Sample n (%)</i>
<b>Karijes iskustvo / Caries experience</b>	
0- kip/aci*=0	191 ( 69,23%)
1- kip/aci< od prosečnog za ispitivani uzrast / average for that age group	14 (5,07%)
2- kip/aci = od prosečnog za ispitivani uzrast / average for that age group	12 (4,34%)
3- kip/aci > od prosečnog za ispitivani uzrast / average for that age group	59 (21,36%)
<b>Udružene bolesti / Related general diseases</b>	
0- Zdravi ispitanici / No disease	276 (100%)
1- Sistemska bolest, bez medikamentozne terapije / Disease/conditions, mild degree, no medication	0,00
2- Sistemska bolest, na medikamentoznoj terapiji / Severe degree, long-lasting, on medication therapy	0,00
<b>Učestalost dijete Diet, frequency</b>	
0- Do 3 obroka dnevno / Up to 3 meals per day	35 (12,68%)
1- 4 –5 obroka dnevno / 4-5 meals per day	191 ( 69,23%)
2- 6 –7 obroka dnevno / 6-7 meals per day	43 (15,57%)
3- > 7 obroka dnevno / > 7 meals per day	7 (2,52%)
<b>Sastav ishrane / Diet, contents</b>	
0- Nizak unos ugljenih hidrata / Low fermentable carbohydrate intake	2(0,72%)
1- Umeren unos ugljenih hidrata / Moderate fermentable carbohydrate intake	86(31,16%)
2- Visok unos ugljenih hidrata / High fermentable carbohydrate intake	132(47,82%)
3- Ekstremno visok unos ugljenih hidrata / Very high fermentable carbohydrate intake	56(20,30%)
<b>OHI-S indeks**</b>	
0- OHI-S <0,3	20(7,24%)
1- OHI-S 0,3 –1,0	118(42,56%)
2- OHI-S 1,1 –2,0	130(47,10%)
3- OHI-S >2,1	8(2,89%)
<b>Program fluorida / Fluoride programme</b>	
0- Konstantna primena suplementa sa fluoridima / maximum' fluoride programme	0 (0%)
1- Suplementi sa fluoridima povremeno / F supplements infrequently	28 (10,14%)
2- Samo paste sa fluoridima / Only F toothpaste	213 (77,17%)
3- Bez primene fluorida / No fluoride	35 (12,69%)
<b>Klinička procena / Clinical judgement</b>	
1- Nalaz u skladu sa procenjenim / Risk according to the other values entered	276 (100%)

\* karijes indeks prosek / Caries Index Average

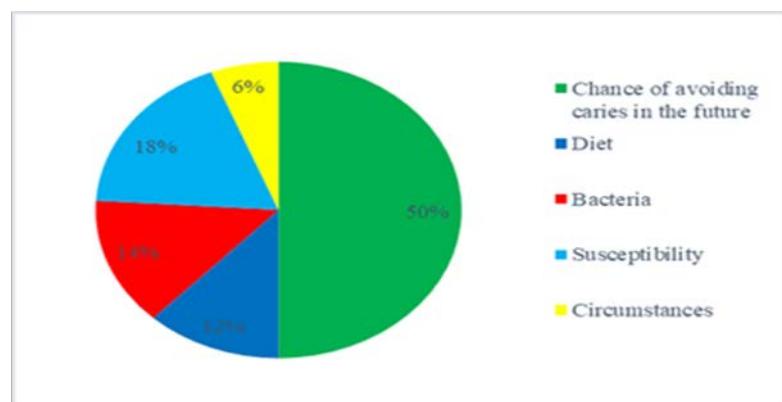
\*\*indeks oralne higijene / oral hygiene index

Prosečan Cariogram® model pokazuje da deca predškolskog uzrasta imaju u proseku 50% šansi da u budućnosti izbegnu pojavu karijesa (Grafikon 1). Najveći procenat ispitanika pripada umerenoj karijes rizičnoj grupi, pri čem najveći broj njih ima između 61 – 80% šansi da u budućnosti izbegne pojavu nove karijesne lezije. Visok rizik od pojave karijesa pokazalo 13,4% dece ispitivanog uzrasta (Grafikon 2).

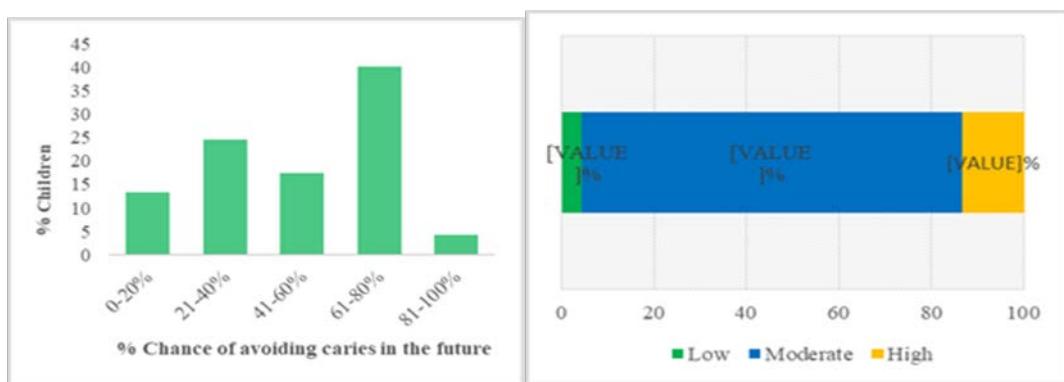
U prosečnom karijes rizik profilu dece ispitivanog uzrasta dominira sektor „osetljivost“ (18%), koji se odnosi na primenu fluorida kod dece ovog uzrasta, iza čega sledi sektor „bakterije“ (14%) (odnosi se na dentalnu higijenu), a zatim sektor „ishrana“ (12%) (odnosi se na varijable vezane za dijetu – sastav i frekventnost unosa hrane).

The average Cariogram® model shows that preschool children have an average of 50% chance of avoiding caries in the future (Graphic 1). The highest percentage of the subjects belongs to the moderate caries risk group, with the largest number of them having between 61-80% chances of avoiding the appearance of a new caries lesion in the future. Thirteen point four percent of the children of the studied age showed a high caries risk (Graphic 2).

The average caries risk profile of the children of the examined age was dominated by the "susceptibility" sector (18%), which referred to the use of fluoride in children of this age, followed by the "bacteria" sector (14%) (referred to dental hygiene) and then the "nutrition" sector (12%) (referred to variables related to nutrition - composition and frequency of food intake).



**Grafikon 1.** Prosečan karijes rizik profil dece predškolskog uzrasta u Nišu  
**Graphic 1.** The average caries risk profile of preschool children in the City of Niš



**Grafikon 2.** Grafički prikaz šansi da se u budućnosti izbegne pojava karijesa i procenjeni stepen rizika za nastanak karijesa ispitanika  
**Graphic 2.** Chance of avoiding caries in the future and estimated caries risk levels

## Diskusija

Polazeći od značaja poznavanja karijes rizik profila subpopulacije u riziku za primarnu prevenciju karijesa, cilj studije bila je analiza karijes rizik profila dece predškolskog uzrasta u Nišu.

U ispitivanoj grupi zdrave predškolske dece u Nišu, starosti od 36 do 48 meseci, registrovana je umerena prevalencija karijesa, sa vrednostima ispitivanih parametara prevalencije karijesa, koji se uglavnom poklapaju sa aktuelnim podacima<sup>3,4</sup>. Međutim, studija je registrovala nepovoljnju strukturu kep-a, sa izrazitom dominacijom neasniranih, karijesnih zuba, što sugerise to da predškolski uzrast dece ovog regiona treba i dalje smatrati visoko karijes rizičnim periodom.

Studijom je procenjeno da najveći broj ispitivane dece pokazuje umereni rizik od nastanka karijesa, dok 13,4% njih pripada visoko karijes rizičnoj grupi. U procenjenom karijes rizik profilu dece, najugroženiji su sektori „osetljivost“ i „bakterije“, koji se odnose na primenu fluorida kod dece ovog uzrasta i njihovu oranu higijenu.

Dobro je poznato da fluoridi i dalje pokazuju najjači kariostatičan efekat i da je njihova kontrolisana primena još uvek najjača karijes preventivna mera. Programom primene fluorida, koji je Evropska akademija za dečju stomatologiju usvojila 2000. godine, a revidirala 2009. i 2019. godine<sup>19</sup>, prednost je data egzogenoj primeni fluorida, koja se smatra sasvim dovoljnom u području u kojem je koncentracija fluorida u vodi za piće optimalna, tj. iznad 0,3 mgF/L. To u Nišu nije slučaj, pa se pored pasti za zube zahteva primena fluorida u vidu suplemenata. Bazirano na rezultatima ove studije, najčešći izvor fluorida kod dece ovog uzrasta su paste za zube, dok suplemente u vidu tabletica povremeno koristi ili je koristilo 10% dece. Oko 12% ispitanih dece ne koristi fluoride ni u kom obliku. Stoga, može se smatrati da je u ovom uzrastu dece izloženost zuba fluoridima nedovoljna i da je, pri razvijanju karijes preventivnih mera i strategija, poželjno razmotriti i sprovođenje programa za primenu fluorida prema predloženom proteokoluod strane Evropske akademije za dečju stomatologiju.

Studijom su utvrđene vioske vrednosti plak indeksa, što sugerise na neophodnost detaljnije analize glavnih kriterijuma za procenu urednosti izvođenja oralne higijene –učestalosti, redovnosti, frekventnosti i tehnike pranja zuba.

## Discussion

Starting from the importance of the knowledge of the caries risk profile of a subpopulation at risk for primary prevention of caries, the aim of the study was to analyse the caries risk profile of preschool children in the City of Niš.

In the studied group of healthy preschool children in Niš aged 36 to 48 months, a moderate prevalence of caries was registered, with values of the examined parameters of caries prevalence that are generally in accordance with current data<sup>3,4</sup>. However, the study registered an unfavourable DMF structure, with a pronounced dominance of untreated, decayed teeth, which suggests that the preschool age of children in this region should still be considered a high caries risk age.

The study determined that the largest number of examined children showed a moderate caries risk, whereas 13.4% of them fell into the high caries risk group. In the assessed caries risk profile of the children, the most vulnerable sectors were "susceptibility" and "bacteria", which referred to the use of fluoride in children of this age and their oral hygiene.

It is widely recognized that fluorides exhibit the strongest cariostatic effect and that their controlled application is still the strongest caries preventive measure. The fluoride application program adopted by the European Academy of Paediatric Dentistry in 2000 and revised in 2009 and 2019<sup>19</sup> gives preference to the exogenous fluoride application, which is considered quite sufficient in areas where the concentration of fluoride in drinking water is optimal, i.e. above 0.3 mgF/L. Since this is not the case in Niš, in addition to toothpaste, the use of fluoride in the form of supplements is required. Based on the results of this study, the most common source of fluoride in children of this age is toothpaste, whereas supplements in the form of tablets are occasionally used or have been used by 10% of the children. About 12% of the subjects does not use fluoride in any form. Therefore, it can be considered that the exposure of teeth to fluoride is insufficient at this age and that, when developing caries preventive measures and strategies, it is desirable to consider the implementation of programs for fluoride application according to the proposed protocol of the European Academy of Paediatric Dentistry.

Stoga, programom zdravstvenog vaspitanja treba, pre svega, obuhvatiti roditelje, budući da je briga o zdravlju zuba dece ovog uzrasta njihov zadatok. Međutim, treba napomenuti da ovaj program ne treba zasnivati na samom pružanju informacija, jer to obično daje kratkoročne rezultate<sup>20</sup>, te je neophodna i stalna motivacija i remotivacija, sa ciljem da se zdrave navike prihvate i prenesu na decu, što je često složen i dugotrajan proces.

Iako ishrana jeste jedan od primarnih faktora za nastanak karijesa, studije pokazuju da kao faktor karijes rizika ona nije od većeg značaja, odnosno da je njena uloga često maskirana primenom fluorida i frekventnošću izvođenja oralne higijene.

Redukovani Cariogram® program pokazuje da deca predškolskog uzrasta u Nišu u proseku imaju 50% šansi da u budućnosti izbegnu pojavu nove karijesne lezije. Ovakav rezultat sugerira da bi u periodu od godinu dana kod svakog drugog deteta moglo da dođe do porasta učestalosti pojave karijesa. Prateći takav trend, moglo bi se očekivati da će za godinu dana u ovoj grupi dece doći do statistički značajnog porasta u učestalosti pojave karijesa, što se može smatrati realnim ishodom, a na šta sugerira i svakodnevno kliničko pedontološko iskustvo. Nedvosmisleno, ovakav rezultat sugerira na neophodnost intezivnog rada u oblasti primarne prevencije karijesa kod dece ovog uzrasta, sa ciljem da se izbegnu sve negativne posledice koje karijes i njegove komplikacije nose. To se u prvom redu odnosi na bol, dentogene infekcije i prerani gubitak zuba, koji za sobom povlači poremećaj svih funkcija celokupnog mastikatornog aparata, poremećaj socijalne interakcije dece, što uz ekonomsku komponentu značajno doprinosi narušavanje kvaliteta života dece, ali i njihovih čitavih porodica. Osim toga, prerani gubitak jednog zuba ili većeg broja zuba narušava i dalji razvoj orofacialne regije. Da bi se ove negativne posledice mogle izbeći, jedna od rešenja mogli bi da budu i protetska rehabilitacija mlečnih zuba i izrada čuvara prostora, koji u ovom uzrastu mogu biti prilično kompleksna i neprihvatljiva opcija za najmlađe pacijente. Sve ovo potvrđuje značaj primarne prevencije karijesa od najranijeg detinjstva, zbog čega ona predstavlja bazični korak u kliničkom pristupu karijesu.

The study determined high values of plaque index, which suggests the need for a more detailed analysis of the main criteria for assessing the maintenance of oral hygiene - frequency, regularity, frequency and technique of toothbrushing. Therefore, the health education program should primarily include parents, given that taking care of the dental health of their children at this age is their task. However, it should be noted that this program should not be based solely on the provision of information as it usually gives short-term results<sup>20</sup>, and that constant motivation and remotivation are necessary to adopt healthy habits and transmit them to children, which is often a complex and time-consuming process.

Even though diet is one of the primary caries factors, studies have shown that as a caries risk factor it is not of great importance, i.e. that its role is often masked by the use of fluoride and the frequency of oral hygiene.

The reduced Cariogram® program shows that preschool children in Niš have an average of 50% chance of avoiding the appearance of a new caries lesion in the future. This result suggests that every other child may have an increased incidence of caries over one year. With such a trend, in this group of children in a year, it may be expected there will be a statistically significant increase in the incidence of caries, which can be considered a realistic outcome, as suggested by everyday clinical pedodontological experience. Undoubtedly, this result also suggests the need for intensive work in the field of primary prevention of caries in children of this age to avoid all negative consequences that caries and its complications bring at this age. This primarily refers to pain, dentogenic infections and premature tooth loss, which leads to disruption of all functions of the entire masticatory apparatus, and disruption of social interaction of children, which, along with the economic component, significantly contributes to the impaired quality of life not only of children but of their entire families as well. Also, premature loss of one or more teeth impairs further development of the orofacial region. To avoid these negative consequences, one of the solutions could be prosthetic rehabilitation of primary teeth and making space maintainers, which can be quite complex at this age and unacceptable for the youngest patients. All this confirms the importance of primary prevention of caries from the earliest childhood, which is why it represents a basic step in the clinical approach to caries.

## ***Zaključak***

Registrovana umerena prevalencija karijesa u ispitivanoj grupi dece ukazuje na to da se ovaj razvojni period može smatrati visoko karijes rizičnim, te ga treba posebno sagledati u oblasti primarne stomatološke zdravstvene zaštite dece. Bazirano na razultatima studije, najznačajnijim karijes rizik faktorima mogu se smatrati nedovoljna izloženost zuba fluoridima i neadekvatana oralna higijena, što treba razmotriti prilikom izbora mera i strategija za prevenciju i kontrolu bolesti. Uz to, neophodno je ponovo razmotriti i vreme dijagnostičkih pregleda, sa ciljem da se prevalencija karijesa i njegove negativne posledice u ovom uzrastu svedu na minimum.

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## ***Conclusion***

The registered moderate prevalence of caries in the examined group of children indicates that this developmental period can be regarded as a high caries risk period, and should be particularly considered in the field of primary dental health care of children. Based on the results of the study, insufficient exposure of teeth to fluoride and inadequate oral hygiene may be considered the most significant caries risk factors, which should be taken into account when choosing measures and strategies for disease prevention and control. Furthermore, it is necessary to reconsider the time of diagnostic examinations to reduce the prevalence of caries and its negative consequences at this age to a minimum.

## ***Conflicts of Interest statement***

The authors declare no conflicts of interest.

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