

Research Article

Dental Caries Experience among 5 Year Age Children from Two Municipalities Berovo and Pechčevo in the Eastern Region of the Republic of Macedonia

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Abstract

Aim: The aim of this study was to investigate the prevalence of dental caries experience among 5 year age children (first grades) in Eastern Region of the Republic of Macedonia.

Methods: In this cross-sectional study, primary school children from first grades (N= 228) were selected from 3 Central and 7 Regional Primary Schools. Participant's dental status was evaluated using the 1997 World Health Organization caries diagnostic criteria for Decayed, Missing or Filled Teeth (DMFT) by 2 calibrated examiners.

Results: The total number of children in the sample was 228, comprising 114 (50.00%) females and 114 (50.00%) males. The mean dmft was 6.01, with standard deviation (sd) of 3.93 and 95% confidence interval (ci) of 3.42-4.44. The Significant caries (SiC) index was 8.83 for primary dentition. The mean DMFT was 0.075, with standard deviation (SD) of 0.39 and 95% confidence interval (CI) of 0.34-0.44. Significant caries (SiC) index was 0.22 for permanent dentition. The prevalence of caries-free children was 9.09% in primary dentition. The percentage of untreated caries or the ration of dt/dmft was 0.8293 (82.93%).

Conclusions: Dental caries experience was seen to be high among primary school children (first grades) in Eastern Region of the Republic of Macedonia. Most of the dental caries from the teeth of primary dentition were left untreated.

Keywords: Caries; Caries prevalence; DMFT index; Macedonia

Introduction

Dental caries is the most common dental health problem affecting young children populations in both developed and developing countries around the world [1]. Caries is very common among 6-year-old children from Pechčevo and Berovo with a prevalence of 91.67%. Moreover, 82.93% of caries remains untreated at this age. Untreated dental caries is often associated with discomfort or toothache, affects the body weight gain, growth and quality of life as well as the cognitive development of preschool children [2], and is also related to their hospitalization [3] and emergency dental visits [4].

Dental caries as an infectious disease is still a major oral public health issue [5]. As documented in some recent studies, it has been recognized as the most common chronic childhood disease.

According to some recent studies which were conducted among American children, it has been recognized as the most common chronic childhood disease [6]. However, epidemiological data representing oral health status, particularly referring to dental caries among Macedonian school children are still insufficient and incomplete.

In respect to the natural characteristics, regardless the small territory, the municipality of Pehčevo is very interesting and heterogeneous. From geological aspect, this area is consisted of rocks with different age starting with oldest Precambrian rocks,

younger Paleozoic rocks (schist, granite), the youngest Pliocene, sediments formed as results of temporary flooding along ravines, soil debris, alluvial sediments and other modern sediments which cover almost 70% of the area. In the area of the municipality, on top Kadiica are discovered large beds of copper (about 70 million tons and a concentration of 0.2%), which will soon begin to be exploited. Around the villages Pancharevo and Crnik however, there are certain coal reserves.

Pehčevo Municipality has 6.775 hectares high quality forest wealth. From vegetation aspect, the majority of the municipality of Pehčevo is covered with deciduous, coniferous and mixed forests. The spring area of Bregalnica is rich with dense complexes of beech, pine and fir forests, and a rarity in the eastern part of Macedonia. In addition to the forests, pastures occupy a large area, which appears to be more endemic plants for the eastern part of the Republic of Macedonia. In addition to the forests, large area is covered with pastures, and is rich with a great number of endemic plants.

The municipal area of Pehčevo has dozens of weak but cold low-mineral springs. Some of them are attached to taps and water supply. The most significant hydrographic facility, in addition to the river is Bregalnica the Pehčevska river the spring of which is under the Kadiica peak at an altitude of 1,560 meters. The riverbed consists of approximately 100 watercourses (with a total length of 540 km), mainly periodic or occasional and with overflowing character. Longest

watercourses (more than 10 km) at the area of the municipality are: Bregalnica Zhelevica, Pehchevska River, Pancharavska River and others. The torrential streams, during heavy rains, cause spills from its riverbed, floods, erosion and deposition of sediment material and in this regard the river Zhelevica is especially characteristic which has been problematic during the history. In the second half of the last century it is very well organized especially around the city Pehchevo. There are no lakes on the territory of the municipality, but larger pools in the highest parts of Maleshevo Mountains near Chengino Kale.

The Municipality of Berovo, which is part of the Maleshevska valley, has a moderate continental climate with modification in the high mountain and lowland areas. Berovo is acity with the highest concentration of oxygenin the Balkans. The mean annual temperature in the municipality is 11,1°C. Oak and beech forests are the most common in the area. Beech zone is common for the mountain and lower areas. The mountain beech forests are better preserved, they are of great importance for forest management.

The most significant hydrographic plant in the Maleshevija region is the river Bregalnica, which in the same time is the biggest confluent of the river Vardar. Another significant hydrographic object which is of importance for the municipality is as well the Berovsko lake. It is an artificial lake with a concrete dam 53 meters high and is a hydrographic tourist facility. It is located at 986 meters altitude. Built in 1970, on the Ratevska river, in the area called Laki, and it is 7 km from the town. The length is 2.5 km and the average width is 0.5 km. The surface of the lake is 0.57 km². The mineral raw materials and the mining are very significant for the developing possibilities of the municipality. Researchers have been carried out in the past and it has been verified that exploitation thereof is economically justified. Such are the cases with the kaolin clays suitable for production of ceramic and fireproof products, quartz, which is fully suitable for preparation of fireproof materials, coal, iron and other mining occurrences that are partially active, and most of them are still only potentially attractive resources for further study and activation.

In the region of village Machevo and village Budinarci exists SiO₂ (mountain crystal) which in other parts of the world is used as ornamental stone in the jewelry production.

According to the census in 2002, the municipality of Berovo has a population of 13.941 citizens. The sex structure of the population is 50,4% males and 49,6% females. The municipality of Berovo has a total number of 4.706 households, with an approximate number of 3,1 members per household. According to the nationality, the Macedonians are dominant with 96%, 3% are gypsies, and 1% other nationalities.

According to the number of companies, the dominant business is the trade (40%), then the traffic services, storage and relations (with 13%) and the processing industry (with 12,3%), other communal, cultural, general and personal service activities (11%), hotels and restaurants (with 7,2%), agriculture, hunting and forestry (with 7,1%) and other (with less than 10%). The most dominant sectors in the economy are textile and wood industry, as well as the agriculture and livestock breeding, where enormous unused potential has been identified. Big progress has been identified in the tourist sector,

which according to the rate and the investments may become main economic branch in near future.

Unfortunately, the number of students in this region of Macedonia from day today decreases primarily because the parents walking children to work abroad, mainly Italy and Switzerland, but also because of the negative natural population growth in the region.

In Berovo municipality, in the school year 2011/2012 a total number of 84 students have been enrolled in the first grade, and a total number of 40 students enrolled in first grade in Pechčevo municipality [7].

Ministry of Health together with experts in the field of preventive dentistry in July 2007 prepare the Strategy for prevention of oral diseases in children from 0 to 14 years of age in the Republic of Macedonia for the period from 2008 to 2018 and submit it to the government of the Republic of Macedonia for adoption. Adopted strategy began to be implemented in 2008. The program objectives of the National Strategy for preventing the oral deseases have been shared in shorth term, medium term and long term objectives, whose aim is elimination of the caries. The Strategy includes a prevention of periodontal disease and orthodontic anomalies. The prevention of the caries will be performed by using five preventive measures: 1. Mechanical and chemical control of the dental plaque 2. Discipline of sugar take regime 3. Application of fluorides (systemic and topic) 4. sealing fissures and cavities 5. Education and motivation for sustainability of oral health.

In the frame of the Strategy, we planed a dental dispensarisation of children through registering data at the patients file, as propose by WHO, and arrangement of preventive teams and professional assistance of paediatrics and gynecologists.

The health strategy determines the statusof preventive dental health care in the Republic of Macedonia, which incorporates the following: Preventive dental protection of children from 0–14 years of age which shall continue to be provided by the Public Health Institutions, by the establishment of a network of institutions for oral health prevention, that shall be fundedby public funds. Therefore, a plan shall be elaborated for the issue of providing premises,equipment, personnel and a package of offered services, furthermore, a geographical distributionof the current specialists in preventive and paediatric dentistry shall be conducted, considering the fact that at the moment they are present only in the larger cities of the country.

Dentists shall operate within a team together with a dental nurse, and they will perform additional training of nurses in preventive dental protection [8]. With the aim of full and successful implementation of National Strategy, Coordinative body decided to prepare a manual (handbook) that is intended for specialists in pediatric and preventive dentistry and general dental practitioners working children, and to all those who are involved in direct or indirect ways in the implementation of the National Strategy (dental nurses, gynecologists, primary care, teachers and primary school, kindergarten educators) [9].

With the full and proper implementation of these guidelines by all involved in the implementation of their national strategy is expected

to result in improved oral health of the population in Macedonia. For certain optimal time fully expect to achieve oral health standards that the World Health Organization have set as imperative for all its members. With it Republic of Macedonia will also get closer to the level of oral health who has reached the countries of the European Union.

Aim

The aim of this study was to assess the dental caries experience of 5 year old children from first grades in Eastern Region of the Republic of Macedonia. Also, the necessity of this study impose for the monitoring of the outcomes from the implementation of the National Strategy for Prevention of Oral Diseases in children from 0 to 14 years of age, which started to be implemented in 2007.

Methods

The Eastern region of our country has 11 municipalities and 217 settlements. The total population according to the Population census was 181.858 citizens in the Eastern region.

According to the Population census in 2002, the population of the following villages are:

- 321 - 2002 census **Chiflik**
- 375 - 2002 census **Pancharevo**
- 354 - 2002 census **Umlena**
- 321 - 2002 census **Crnik**
- 97 - 2002 census **Negrevo**
- 426 - 2002 census **Robovo**
- 3,237 - 2002 census **Pehchevo**.

The primary school "Vancho Kitanov" Pehchevo has three regional primary schools in villages, as it follows: Crnik, Umlena and Robovo.

The primary school "Dedo Iljo Malesevski" includes seven regional schools, such as: with all the grades in the villages Rusinovo, Budinarci, Mitrasinci and Dvoriste and in the remaining villages Smojmirovo, Vladimirovo, Retevo and Macevo only for the pupils from the first to the fourth grade. The teaching in these schools is performed in the Macedonian language. In this school, 1058 pupils were enrolled in 2006/07, in the four regional schools in the preparatory teaching, 24 pupils were included, in the grades from I-IV-476 pupils were enrolled in 31 classes and from the V-VIII grades, there are 558 pupils classified in 31 classes. The school is located in the city of Berovo.

The primary school "Nikola Petrov-Rusinski" is located in the center of the Rusinovo village. Only the pupils from the Rusinovo village go to this school.

The older population is dominant in the Eastern Region and young population (0-14) has a participation of 15% [10]. In our country 6 years is the age at which children begin primary school. There are 94 primary schools in the Eastern region.

According to the recommendation of WHO, where examination

is practical and feasible to be realized, children should be examined between their 5-th and 6-th birthdays. This age is interesting in relation to the levels of caries in the primary dentition which may exhibit changes over a shorter time span than the permanent dentition at other index ages [11].

The target population comprised all children entering primary school in the municipalities of Pehchevo and Berovo. We used a random-cluster sampling strategy. Using information on governmental support and the full list of primary schools from the two municipalities, provided by the Ministry of Education. The primary schools of the two municipalities were contacted to obtain information on the number of children in the first grade and the number of classes. A total of 10 primary schools provided necessary information and were invited to participate in the study. For schools with few students or fewer than 4 classes, all classes were included in the study. In larger schools, where the number of students in the first grade was >100 and the number of classes was >3, three classes were randomly selected. A total of 13 classes were finally selected and included in the study.

Participants were randomly selected from a population sample of 6 years old school children and the study group was comprised of 99 (51 girls and 48 boys). Participants were examined over one month period in May 2013. Clinical examination of each participant was performed in a dental office of the Health Centers of Pehchevo and Berovo, and was a part of an obligatory check-up which was a prerequisite for enrolling a child in primary school.

All parents/ caregivers signed the informed consent when children came in the Health Center for the first visit. Prior to commencing the study, in order to set up the unique criteria and enable examiners to conduct the study, each of the examiners was trained at the University Clinic by a principal investigator. Each participant received an oral examination sitting in a dental chair. Oral examinations were performed in the artificial light by using a plane mirror and a dental probe.

Inclusion criteria for dental caries were diagnosed clinically and detected as visually apparent cavitations, discolorations of the enamel and/or visually diagnosed recurrent caries lesions. No radiographs were taken at that stage.

Clinically acquired data was stored for each patient separately. Data included information on gender, total number of teeth as well as total number of decayed, missing and filled teeth in both primary and permanent dentitions. According to the WHO criteria, the dental status of primary teeth was coded with the letters from A to G (healthy tooth, filled, decayed, fissure sealing, etc). Permanent teeth were coded with the numbers from 0-9 according to the WHO codes, with 0 referring to "healthy," 1 referring to "decayed," etc. DMFT/dmft scores were evaluated according to the WHO criteria [11].

The following criteria also included D/d component for untreated caries, M/m for teeth which were missing due to caries, and F/f for fillings that were present at the time of examination. Caries severity was determined by DMFT score for permanent teeth and dmft score for primary teeth. Based on the acquired data, caries prevalence, the Significant Caries Index (SiC) were further calculated.

Table 1: Distribution of individuals in studied sample (gender, area).

Area \ Sex	Male	Female	Total
Urban	77	75	152
Rural	37	39	76
Total	114 (50,00%)	114(50,00%)	228

The Significant Caries Index (SiC Index) was used to determine individuals with the highest caries scores in the examined population. One third of the population with the highest caries scores was selected and the mean DMFT score was calculated. Finally, the obtained value constituted the SiC Index [12,13].

Statistical Analysis

Simple descriptive statistical tests were used in the form of percentage and frequency distribution. For statistical analysis of dmft and DMFT scores to assess the oral health among primary school children, the SPSS Statistics 20 for statistical computing was used.

Statistical analysis was accomplished by using non-parametric Mann-Whitney U Test to see if there are differences in mean DMFT scores between sex and area groups. Kruskal-Wallis Test was performed to see if there are differences in mean DMFT scores between the cities group. Descriptive statistic was performed by calculating median and interquartile range. A standard statistical package SPSS Statistics 20 was used for performing the data analysis.

Results

Statistical data that was collected were from primary school children in the Eastern part of the Republic of Macedonia. For each child following data was recorded: age, sex (male or female), ethnic group, area (urban or rural), city/village, number of decayed teeth (dt), number of missing teeth (mt) and number of filled teeth (ft). Then, the dmft score, the sum of dt, mt and ft, was calculated and recorded for each child. The size of the statistical sample was 228.

Table 2: Distribution of individuals in studied sample (city/village of living, ethnic affiliation).

ethnic affiliation \ City/Village of living	Macedonians	Roms	Turcs	Total
Berovo	65	1	11	77(33,77%)
Pehčevo	70	1	4	75(32,89%)
Crnik	0	8	6	14(6,14%)
Umlena	5	0	0	5 (2,19%)
Robovo	4	0	0	4 (1,75%)
Smojmirovo	5	0	0	5 (2,19%)
Budinarci	5	0	0	5 (2,19%)
Ratevo	11	0	0	11(4,82%)
Dvorište	9	0	0	9 (3,95%)
Rusinovo	11	0	0	11(4,82%)
Mačevo	1	0	0	1 (0,44%)
Mitrašinci	6	0	0	6 (2,63%)
Čiflik	3	0	0	3 (1,32%)
Pančarevo	2	0	0	2(0,88%)
Total	197(86,40%)	10(4,39)	21(9,21)	228(100%)

In Table 1 and 2, the distribution of individuals in studied sample is given.

The mean value of the dmft index for the whole sample is 6.01, with standard deviation (SD) of 3.93, and 95% confidence interval (CI) of 3.42-4.44. In the whole sample, 8.33% of the individuals were caries free for primary teeth (dmft=0). As a complement of the mean dmft value, for the whole sample, the SiC index of 8.83 was calculated.

In Figure 1, the distribution of dmft score is given. The mean dmft index with SD and 95% CI were calculated for each group (according to sex orientation, area of living, age, nationality, city or village) and these results are reported in Table 4. Only three ethnical groups (Macedonians, Roms and Turcs) were examined. Among the groups formed by city or village of living the Kruskal-Wallis Test was performed to see if there are differences in mean dmft index and corresponding p-value is reported in Table 3. For city/village groups, the result is that there is no statistically significant difference between groups from Pehčevo, Berovo, Dvorište and Crnik (p-value=0.080, p>0.05).

The dmft components, dt, mt and ft, were also analyzed. Their frequencies, mean values, SD's and 95% CI's are reported in Table 4. It is important to describe the composition of the DMFT, which allows us to evaluate the level of dental care in the country.

Mean DMFT of the permanent dentition of the whole sample was 0.075 (\pm 0.39) and CI (0.34-0.44).

Discussion

The present results revealed that the prevalence of caries in 6-year old children living in municipalities of Berovo and Pehčevo is 90.91%. The results of our study are higher to those reported for Italian, British and Norwegian 5-year old children (40%, 38% and 34% respectively) [14-16]. The caries prevalence was 85%, in the study of Zhang et al. in 5-year-old Bulang children from China, with

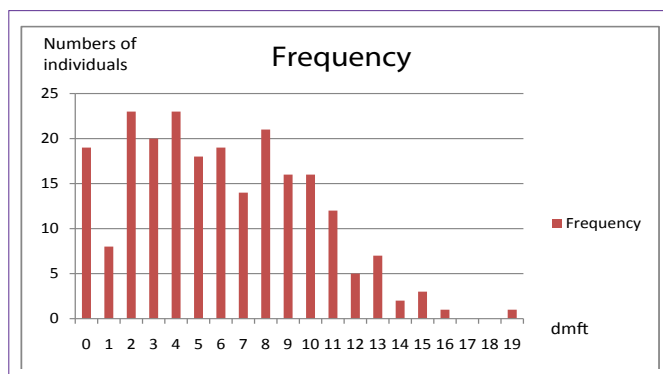


Figure 1: Distribution of dmft score of primary teeth in the whole sample.

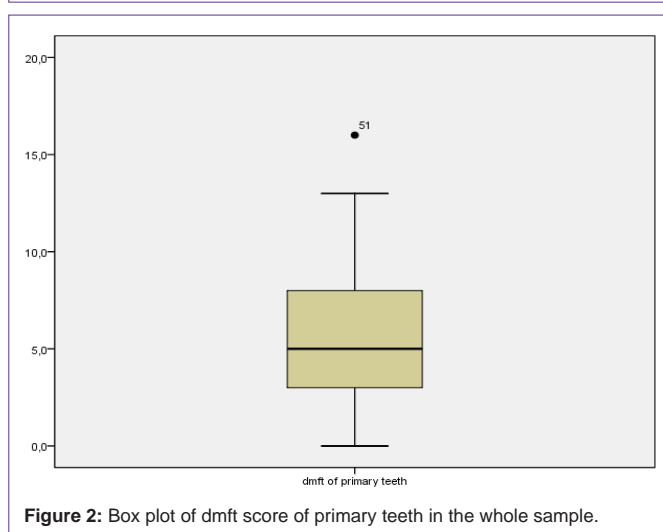


Figure 2: Box plot of dmft score of primary teeth in the whole sample.

the mean dmft score of 5.8 ± 4.9 [17]. Results of Jokić et al. [18] in Croatian 6-year school children from Primorsko-Goranska a country showed that the mean dmft was 4.68 ± 4.19 , and the mean DMFT was 0.22 ± 0.69 .

In our study caries-free 6 years old children living in Berovo, Pechčevo and surround villages were found to be 8.33%.

The mean dmft score of $7.24 (\pm 3.73)$ in the rural area in comparison to the dmft score of $5.70 (\pm 4.0)$ in urban area can be explain by the limited access to dental treatment, especially in the rural areas. In the present study, the inclusion of children at this age allowed to show a gradual development of the caries process with the years of life. The data obtained herein showed that the majority of carious teeth had not been treated. At the moment no one specialist of pediatric and preventive dentistry is on duty in the municipality of Berovo.

In our study the mean DMFT was 0.075, with standard deviation (SD) of 0.39, which is lower score in comparison with the result of 0.09 ± 0.39 for 6-year-old children find in the study of Bialystok District, Poland by Bagińska J et al. [19].

The Scientific project designed upon the World Health Organization Criteria and directed by Nečeva [20] was conducted in four districts (Skopje, Veles, Štip and Ohrid) in the Republic of Macedonia. A total of 1034 subjects from urban and rural population groups aged 6, 12, 15, 18, 35-44 and over 65 from the whole Republic were examined. The DMFT score of 0.69 was fined for permanent

dentition in 6 year-old children in 1991.

Even in 1979 Tafciovski at all, when studying the national pathology of dental terms, noticed that there is reverse proportional relationship between caries process and the concentration of fluoride in drinking water [21].

The mean DMFT in the majority of countries was below 3.0 and in the countries of North-Western Europe and the USA it was below 2.0 (Marthaler TM et al. [22], ORCA). However, other European populations, particularly those living in the Mediterranean area, had different results.

The significant dental treatment needs among caries-prevalent children, found in the present study, maybe attributed to the Macedonian oral health care system, which is primarily delivered by the private sector. It must also be noted that there is no water fluoridation in the Republic of Macedonia. Also the concentration of natural fluoride in the drinking water supply is 0.0495 ppm F in Berovo and 0.268 ppm F in Pechčevo. It is very surprising that the mean dmft in Crnik is 6.43 regardless of the 0.91 ppm F in drinking water from this village. With regard to the gender factor, boys were associated with higher dmfs scores. In the study of Mantonanaki M et al. [23], conducted on 5-year-old children living in Attica, girls were associated with higher dmft scores.

According to the literature, being a girl is a strong predictor for severity of caries because they have an earlier tooth eruption [24]. The statement that gender was not related to the occurrence of caries was supported by the Ferro and co-workers [14]. Declerck and co-workers, in their study of preschool children in Northern Belgium, also found that girls were 4.67 times more likely to have decayed, missing, filled teeth (dmft) value > 5 . Sugar containing drinks between meals were also found to be a risk indicator for dental caries in 5-year-old children in Belgium [25].

We also found that the distribution of caries in the evaluated population was irregular. Our results proved the thesis introduced by Brathall [12] that, in every population, a part of it is seriously affected by caries. One of the limitations of our study is that we obtained no information on the oral hygiene practices, the kind of diet and the access to the fluoride prophylaxis. They are well-known caries risk factors and the future caries development in the evaluated population is strongly dependent on them. Another limitation is that we did not use the ICDAS system which gives more detailed description on the severity of caries.

Oral health promotion programmes in our country should include preventive measures, recommendations on sugar consumption and maternal education, while public health strategies should focus on community empowerment and development of accessible and responsive dental services.

One of the WHO objectives recommended for the year 2020 is to reduce inequalities in oral health across populations [26]. For that purpose, extensive caries prevention and treatment actions directed at the group of children most affected by caries should be undertaken.

Conclusions

The prevalence of dental caries in 6-year-old children from municipalities Berovo and Pechčevo from Eastern Region of the

Table 3: Caries free individuals, dmft scores and equality tests for mean dmft index.

	caries free	dmft		p-value
		Mean (SD)	95% CI	
whole sample	19 (8,33%)	6.01(3.93)	3.42-4.44	
sex groups				
male	12(5,26%)	6.66 (4.06)	3.31-4.31	0.063 (p>0.05)
female	7 (3,07%)	5.37 (3.70)	3.02-4.38	
area groups				
urban area	15(6,58%)	5.70 (4.00)	3.36-4.64	0.002 (p<0.05)
rural area	4 (1.75%)	7.24 (3.73)	2.89-4.57	
ethnic groups				
Macedonians	15 (6,58%)	5.97 (3.97)	3.42-4.52	
Roms	2 (0,88%)	6.3 (5.98)	2.27-9.69	
Turks	2 (0,88%)	6.24 (3.55)	2.03-5.07	
city/village Kruskal-Wallis Test				
Pehčevo	8 (3,51%)	5.99(4.32)	3.34-5.30	0.080 (p>0.05)
Berovo	7 (3,07%)	5.36(3.66)	2.84-4.48	
Crnik	2(0,88%)	6.43(5.08)	2.42-7.74	
Ratevo	0(0%)	8.00(3.32)	1.36-5.28	
Rusinovo	0(0%)	6.91(3.05)	1.25-4.85	

Table 4: dt, mt, ft frequencies and scores for the whole sample.

	frequency	Mean (SD)	95% CI
dt	84.48%	4.7676 (3.3222)	2.6678-3.9766
mt	7.51%	0.4242 (1.0982)	0.8819-1.3145
ft	8.05%	0.4545 (0.9612)	0.7719-1.1505

Republic of Macedonia was high (91.67%) and varied between the cities and villages from 96.93% in Berovo, 96.49% in Pehčevo, 99.12%in Crnik to 100% in Ratevo and Rusinovo. The mean dmft was 6.01±3.93 and varied between cities and villages from 5.99(±4.32) in Pehčevo, 5.36 (±3.66) in Berovo, 6.43 (±5.08)in Crnik, 6.91(±3.05)in Rusinovoto 8.0 (±3.32) in Ratevo. Most of the dental caries from the teeth of primary dentition were left untreated.

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Statement of conflict of interest

In the opinion of the authors, there is no conflict of interests.

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