DETERMINATION OF THE STRUCTURE OF THE DECAYED, MISSING AND FILLINGS OF THE TEETH INDEX FOR THE FIRST PERMANENT MOLARS AT TWELVE-YEAR-OLD CHILDREN IN THE POLOG REGION

ОДРЕДУВАЊЕ НА СТРУКТУРАТА НА ИНДЕКСОТ НА КАРИЕС, ЕКСТРАКЦИИ И ПЛОМБИ НА ПРВИТЕ ТРАЈНИ МОЛАРИ НА ДВАНАЕСЕТ ГОДИШНИ ДЕЦА ВО ПОЛОШКИОТ РЕГИОН

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Abstract

Aim: The aim of this study is to evaluate the condition of the first permanent molars and determine the prevalence of caries, extraction and fillings in these molars in the Polog region. **Materials and method:** A total of 2736, 12-year-old children from the municipalities of Tetovo and Gostivar were included in the examination. The dental status of the children was systematically assessed through comprehensive examinations. **Results:** The prevalence of dental caries in the first permanent molars among the examined children in Tetovo and Gostivar municipalities, was found to be 39.4%. Specifically, carious lesions were observed in 19.35% of children in Tetovo, and 18.68% of children in Gostivar. The percentage of extracted teeth, as indicated by the DMF - index for the first permanent molars, was 1.33%, in Tetovo and 1.14% in Gostivar. **Discussion:** the obtained results showed no statistically significant difference in the DMF-index structure between the municipalities of Tetovo and Gostivar. However, a significant difference was observed in relation to caries, with girls demonstrating greater attention to oral hygiene. **Conclusion:** Urgent implementation of enhanced preventive measures and procedures outlined in the National Strategy for improving the oral health in the Republic of North Macedonia is necessary. **Key words:** dental caries, first permanent molar, structure of the DMF-index, oral health, preventive measures.

Апстракт

Цел: Целта на оваа студија е да се провери состојбата на првите трајни молари и преваленцата на кариес, екстакција и пломби на првите перманентни молари во Полошкиот регион. **Материјал и метод:** Вкупно 2736, 12 годишни деца од општините Тетово и Гостивар беа испитувани. Истражувањето беше спроведено на терен во школските амбуланти и училници, преку систематски прегледи кај деца за проценка на денталниот статус. **Резултати:** Преваленцата на денталниот кариес на првите трајни молари во општините Тетово и Гостивар, изнесува 39.4%. Процентот на застапеност на кариозни лезии на заби во градот Тетово изнесува 19.35%, во градот Гостивар е нешто понизок и изнесува 18.68%. Процентот на екстрахирани заби претставени со КЕП-индексот за првите трајни молари кај испитаниците од Тетово изнесува 1.33%, а кај испитаните во Гостивар изнесува 1.14%. **Дискусија:** Од добиените резултати се согледува дека не постои статистички сигнификантна разлика на структурата на КЕП-индексот во однос на општините Тетово и Гостивар. Беше утврдена статистички сигнификантна разлика на структурата на КЕП-индексот по пол, во однос на кариес, каде девојчињата посветувале поголемо внимание на оралната хигиена. **Заклучок:** Потребно е ургентно преземање на засилени превентивни мерки и постапки на компоненти од Националната стратегија за подобрување на оралното здравје во Република Северна Македонија. **Клучни зборови:** дентален кариес, прв траен молар, структура на КЕП-индекс, орално здравје, превентивни мерки.

Introduction

The first permanent molars hold great significance in over all oral health as they are considered the most important teeth in the permanent dentition. Their specifications require special attention due to their role in occlusion, articulation and mastication. These molars typically erupt around the age of six, marking the beginning of the period of the mixed dentition[1,2]. Their proper positioning is of crucial significance for the subsequent

development of occlusion. Concurrently, as these molars erupt, there is a vertical growth of the alveolar ridge, resulting in the elevation of the bite and a secondary physiological change.

The first permanent molars play a vital role in occlusion[3,4] and are crucial for the proper development of orofacial functions, particularly mastication. These teeth have an important role in the intercuspidation and the alignment with other teeth. The premature loss of these molars can lead to adjacent teeth tilting and angulation towards the empty space, potentially causing orthodontic malocclusion. Extensive research in the literature[5] shows that the first permanent molars facilitate the correct alignment of the other permanent teeth, ensuring the proper length of the dental arch, bite height, intercuspidation, of the teeth, masticatory function, and the stability of occlusion. Given their pivotal role in occlusion, it is essential to retain these teeth within the oral cavity to prevent dental morbidity and to carry out preventive and therapeutic procedures by dental professionals. Dentists should prioritize the prevention of caries of these teeth and, when necessary, provide conservative treatments.

The statements above highlight the significant role of the permanent molars in intercuspidation of the teeth. These molars are characterized by their large mesio-distal chewing surfaces and are subjected to the highest masticatory pressure. Chronologically, they erupt before the other permanent teeth and, along with deciduous teeth contribute to chewing function. The occurrence of caries, indicated by the formation of cavities, disrupts the balance between the factors that influence the process of remineralization and demineralization of enamel in the oral cavity. Caries is caused by the presence of oral bacterial flora as well as other factors such as tooth structure and saliva. Recent studies[6] reveal a consistent reduction in caries prevalence in developed countries due to robust health education initiatives focused on improving the hygiene practices, dietary habits, reducing pure sucrose and sugar consumption, and preventive programs.

Preventing caries involves implementing measures such as maintaining proper oral hygiene practices and receiving fluoride treatments. Indices that describe the prevalence of caries and periodontal disease are commonly used to describe the proper oral status of populations. One important index-parameter that is introduced for identification of certain subjects and groups with appropriate involvement of caries or decay is the decay, missing teeth and fillings on the teeth index (DMF-index)[7] and its structure is a relevant indicator of the oral health and reflects the socioeconomic status of a population[8,9]. However, countries undergoing development in Europe are still coping with a high prevalence of dental caries (cavities), particularly among school-aged children.

The first permanent molars are particularly susceptible to caries. When these teeth erupt, they are exposed to an environment that is contaminated with different microorganisms, especially those from carious deciduous teeth. During this period, the enamel is immature and has a porous crystal structure, making it prone to rapid occurrence of caries. The teeth have pronounced tubercles, deep fissures and difficult-to-reach areas that hinder cleaning and self-cleaning. Additionally, the tooth crown remains covered by the gingiva for a long time, allowing food retention. Being the first permanent teeth to emerge, they are exposed to harmful environmental factors and their position behind the similar looking second deciduous molars often leads parents to overlook them or mistake them for deciduous teeth that will be replaced.

According to the research conducted in the city of Prilep[10], in 2015, among 6-year-old school-aged children in both urban and rural areas, the prevalence of dental caries in the examined group was 58.66%. In an urban environment the risk was 52.29%, and in a rural environment it was slightly higher by about 5%. The first permanent molar had the highest caries prevalence among all remaining teeth in the permanent dentition from 40% to 60%. Furthermore, more than 50% of children over the age of 11 had some form of caries, regardless of whether it was superficial, intermediate or complicated[11].

According to the American Dental Association[12], the oral health encompasses functional, structural, aesthetic, physiological and psycho-social well-being, and it significantly influences the general state of health and quality of life of each individual. The World Health Organization (WHO) and the World Dental Association (FDI) have established average values for the structure of the DMF-index in 12-year-old children, characterized as follows: too low 0.0-1.1; low 1.2-2.6; medium 2.7-4.4; high 4.5-6.5 and too high > 6.5.[13]

Aim of the study

The aim of this study is to evaluate the condition of the first permanent molars, determine the prevalence of decay, missing teeth and fillings and analyze the structure of the DMF-index among male and female participants (school pupils) in the municipalities of Tetovo and Gostivar, located in the Polog region.

Materials and method

To achieve the objective of this study, dental examinations were carried out on a total of 2.736 sixth grade students at the age of 12, including 1.449 male and 1.287 female pupils from the Polog region. A total of 1.838 children were examined from the municipality of

Tetovo, comprising 955 boys and 883 girls, while 494 boys and 404 girls were examined from the municipality of Gostivar. The research was conducted and realized between September 2017 and May 2018. The examinations took place at the PHI "Health Center" in Tetovo and the PHI "Health Center" in Gostivar, as well as in school clinics and classrooms. A systematic approach was followed to assess the dental status of the children.

These examinations were carried out in accordance with criteria set by the WHO, using a recommended dental chart for marking. The pupils were examined with appropriate instruments (probe and dental mirror). Sixth-grade students at the age of twelve were selected, as it corresponds to the eruption of all permanent teeth, with the exception of the third molars. This age is also determined as the age of global caries monitoring, as well as international monitoring of dental caries trends.

All the examined children were found to be in good health condition. Based on the obtained data, the structure of the DMF-index for the first permanent molars was calculated for every examinee, using the Klein-Palmer system. The structure of the DMF-index represents the sum of the total number of Decayed (carious), total number of Missing (extracted) and total number of teeth with Fillings. Carious teeth are defined as those in which the probe falls and there is a visible cavity or cavitation on the tooth surface. The structure of the DMF-index for the first permanent molars represents the average number of affected first permanent molars per pupil.

Results

This study included a total of 2.736 examinees, who were 12-year-old children from the municipalities of Tetovo and Gostivar in the years 2017 and 2018. Out of the total number of examinees, data was obtained for 1.448 male children (52.96%) and 1.287 female children (47.03%). Regarding the distribution according to the living environment, 1.838 (67.17%) of the respondents were from Tetovo, and 898 (32.82%) were from Gostivar (table 1).

The structure of the DMF-index shows the risk of the occurrence of a disease of the hard dental tissues, dental caries, within a certain population, as shown in Table 2. The value of this indicator is calculated by dividing the number of examinees with a structure of the DMF-index value greater than zero (indicating the presence of dental disease) by the total number of examinees. It was shown that the structure of the DMF-index especially for the first permanent molars when the whole studied group is considered is 39.4%. In Tetovo, the risk is 38.01%, while in Gostivar it is slightly higher, with an increase of approximately 4%.

In terms of gender, female examinees exhibit a higher risk, with a prevalence of 40.16%, compared to male examinees, where the risk of occurrence of dental diseases is 39.07%. In addition, within the municipality of Tetovo, the risk is higher for female examinees (38.69%) in comparison to male examinees (36.86%), while in Gostivar, the risk for the occurrence of the disease is 43%, which is almost equal for both genders. The female gender in the city of Gostivar (43.3%) shows a slightly higher risk compared to Tetovo and in relation to the overall risk for this gender.

The statistical analysis of the data did not reveal a significant difference in the value of the structure of the DMF-index between the children from Tetovo and Gostivar ($p < 0.50$).

The composition of the structure of the DMF-index can be clearly observed in Table 2.

Similarly, the analysis of the research did not indicate a significantly different structure of the DMF-index

Table 1. A distribution of examinees categorized by gender and municipalities

	Gender			Municipalities		
	Male	Female	Total	Tetovo	Gostivar	Total
Frequency	1449	1287	2736	1838	898	2736
Percentage %	52.96	47.03	100	67.17	32.82	100

Table 2. A presentation of the index of caries, extractions and fillings

Municipality	Decayed teeth	Missing teeth	Filled teeth	Sealed teeth
Gostivar %	18.68	1.14	23.29	56.8
Tetovo %	19.35	1.33	17.21	61.11
Total %	19.13	1.27	19.27	60.33

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Table 3. A presentation of the index of caries, extractions and fillings (DMF-index) for first permanent molar with respect to gender

Gender	Decayed teeth	Missing teeth	Filled teeth	DMF-index
Male	0.78	0.04	0.73	1.55
Female	0.74	0.04	0.81	1.59

Table 4. An analysis of descriptive statistics and an independent samples t-test to compare genders

	Gender	N	Mean value	t-test	Significance
Decayed teeth	male	1449	0.78	0.981	0.604
Decayed teeth	female	1287	0.74		
Missing teeth	male	1449	0.04	0.211	0.807
Missing teeth	female	1287	0.04		
Filled teeth	male	1449	0.73	2.523	0.012*
Filled teeth	female	1287	0.81		
DMF-index	male	1449	1.55	0.275	0.608
DMF-index	female	1287	1.59		

*significant at p<0.05; ** significant at p<0.005; *** significant at p<0.001
not significant at p>0.05

Table 5. A presentation of the DMF-index for first permanent molars specifically for the municipalities of Tetovo and Gostivar

	Decayed teeth	Missing teeth	Filled teeth	DMF-index
Tetovo	0.78	0.05	0.68	1.51
Gostivar	0.70	0.04	0.94	1.68

Table 6. A descriptive analysis and an independent samples t-test comparing the municipalities of Tetovo and Gostivar

Tetovo and Gostivar	Localization	N	Mean value	t-test	Significance
Decayed teeth	Tetovo	1843	0.78	0.445	0.651
Decayed teeth	Gostivar	892	0.70		
Missing teeth	Tetovo	1843	0.05	0.138	0.807
Missing teeth	Gostivar	892	0.04		
Filled teeth	Tetovo	1843	0.68	1.021	0.316
Filled teeth	Gostivar	892	0.94		
DMF-index	Tetovo	1843	1.51	0.996	0.324
DMF-index	Gostivar	892	1.68		

*significant at p<0.05; ** significant at p<0.005; *** significant at p<0.001
not significant at p>0.05

Table 7. A presentation of the DMF-index for the first permanent molars in male children in the municipalities of Tetovo and Gostivar

	Decayed teeth	Missing teeth	Filled teeth	DMF-index
Tetovo	0.76	0.04	0.66	1.46
Gostivar	0.81	0.05	0.86	1.72

Table 8. A descriptive analysis and an independent samples t-test conducted to compare examinees from the male gender between the municipalities of Tetovo and Gostivar

Tetovo and Gostivar	Localization	N	Mean value	t-test	Significance
Decayed teeth	Tetovo	960	0.76	0.494	0.622
Decayed teeth	Gostivar	488	0.81		
Missing teeth	Tetovo	960	0.04	0.238	0.812
Missing teeth	Gostivar	488	0.05		
Filled teeth	Tetovo	960	0.66	0.307	0.759
Filled teeth	Gostivar	488	0.86		
DMF-index	Tetovo	960	2.54	0.689	0.491
DMF-index	Gostivar	488	2.28		

*significant at $p<0.05$; ** significant at $p<0.005$; *** significant at $p<0.001$
not significant at $p>0.05$

Table 9. A presentation of the DMF-index for the first permanent molars in female children in the municipalities of Tetovo and Gostivar

	Decayed teeth	Missing teeth	Filled teeth	DMF-index
Tetovo	0.77	0.05	0.71	1.53
Gostivar	0.67	0.02	1.03	1.72

Table 10. A descriptive analysis and an independent samples t-test comparing the examinees from the female gender between the municipalities of Tetovo and Gostivar

Tetovo and Gostivar	Localization	N	Mean value	t-test	Significance
Decayed teeth	Tetovo	883	0.77	1.021	0.093
Decayed teeth	Gostivar	404	0.67		
Missing teeth	Tetovo	883	0.05	0.205	0.838
Missing teeth	Gostivar	404	0.02		
Filled teeth	Tetovo	883	0.71	0.500	0.617
Filled teeth	Gostivar	404	1.03		
DMF-index	Tetovo	883	1.53	0.598	0.550
DMF-index	Gostivar	404	1.72		

*significant at $p<0.05$; ** significant at $p<0.005$; *** significant at $p<0.001$
not significant at $p>0.05$

between male and female pupils, as evidenced by the Person Chi-square value of 0.50 and $p>0.47$.

Table 3 and 4 present the results of the analysis between the pupils' genders, irrespective of the place of residence. The average values of carious, extracted and filled first permanent molars, representing the DMF-index in the male gender were 0.78; 0.04; 0.73 and 1.55, respectively. It was observed that the highest average value in the male examinees refers to the number of carious teeth compared to the average number of extracted teeth and filled teeth. The female gender is characterized by the following average values: carious teeth 0.74,

extracted teeth 0.04, filled teeth 0.81 and a DMF-index structure of 1.59 (Table 3).

The results of the data analysis and comparative statistics based on the place of residence are presented in Table 5 and 6. The average values for carious, extracted and filled teeth, in the first permanent molars, among the examinees from the city of Tetovo were 0.78, 0.05, and 0.68, respectively. The DMF-index value was 1.51, and the average number of sealed or healthy fissures was 2.49. In the city of Gostivar, the average values for carious teeth were 0.70, for extracted teeth were 0.04, for filled teeth were 0.94. The structure of the DMF-index

was 1.68 and for the sealed-healthy teeth was 2.32. It has been observed that the highest average value among examinees from the municipality of Tetovo and the municipality of Gostivar refers to the number of filled teeth compared to the average number of carious and extracted teeth.

Table 7 represents the structure of the DMF-index for male pupils, which is 1.46 in the municipality of Tetovo, and 1.72 in the municipality of Gostivar.

Descriptive analysis and the t-test for independent samples were used to compare the examinees from male gender between the municipalities of Tetovo and Gostivar (Table 8).

The t-test results did not represent statistical significance.

The DMF-index in female pupils was 1.53 in the municipality of Tetovo, and 0.67 in the municipality of Gostivar, as shown in Table 9.

Similarly, the descriptive analysis and the t-test for independent samples for comparison between examinees from the female gender between the municipalities of Tetovo and Gostivar, did not yield statistically significant results (Table 10).

Discussion

Based on the results obtained, we can discuss several aspects of the structures of the DMF-index. Firstly Table 1 illustrates its distribution by municipalities, namely Tetovo and Gostivar, as well as by gender of the pupils. The total number of examinees in both municipalities was 2.736.

This study provides insights into the dental health of the examinees throughout the values of the DMF-index on their first permanent molars. The analysis indicates that there was no statistical significance in the structure of the DMF-index between the examinees from Tetovo and Gostivar municipalities. The structure of the DMF-index is 43.2% in Gostivar and 37.9% in Tetovo municipality, respectively.

There are significant differences in the measured indices among other similar studies conducted in different states. For instance, in the surveys conducted between 1991 and 1995, the mean value of the DMF-index of the deciduous dentition in children aged 5-7 years ranged between 0.9 and 8.5[14] in Spain (DMF-index 1.0), and in Denmark (DMF-index 1.3). National mean values of the structure of the DMF-index below 2.0 were also reported in Finland, the Netherlands and Norway. Ireland had the lowest value of the structure of the DMF-index of 0.9[14]. These findings highlight the disparity between our study and those conducted in developed countries. Developed countries place significant emphasis on prevention, resulting in lower DMF-index values, low, whereas our study reflects a higher DMF-index values. We need to take inspiration from countries like Finland, the Netherlands and Norway to improve dental and systemic health among our children.

When considering gender differences among children, a notable disparity is observed in the number of teeth with fillings. As shown in Table 3, the male pupils have an average of 0.73 fillings, while female pupils have an average of 0.81 fillings. Our study also revealed that female pupils expressed a more stringent attitude towards visiting the dental office. This observation is further supported by the results in Table 4, where the descriptive analysis and the t-test were analyzed for independent samples for comparison between genders. The p value of 0.012 indicates a great significance in favor of the female gender.

Hua Xi, Kou Qiang[15] et al. conducted a study to investigate the prevalence of caries of the first permanent molar among 7-9 year-old children in Tangshan city. They found that the prevalence rate of caries in the first permanent molar was 47.49% with a mean value of the structure of the DMF index of 1.30 ± 1.59, while the rate of teeth with fillings was only 2.35%. The prevalence rate and the mean value of the structure of the DMF index of the first permanent molars showed significant difference between children's ages and their gender ($p<0.05$), which aligns with our study.

Furthermore, our analysis and the conducted student t-test, showed that the average values of all investigated parameters between the examinees in the municipalities of Tetovo and Gostivar did not differ significantly, as presented in Table 5 and 6.

Many therapists try to find comparison between different groups for the prevalence of caries. Maltz M. et al.[16] conducted a study aimed at determining the relationship between socio-economic status, caries, gingivitis and fluorosis among school-aged children in Brazil. The study included 1000, 12-year-old pupils from both private and public schools, and the structure of the DMF-index was calculated. The socio-economic status was determined according to the family income and educational level of the parents. No association was found between the prevalence of caries, gingivitis and fluorosis in this study. However, there were notable differences in the structure of the DMF-index between children in private and public schools. The structure of the DMF index for children in private schools was 1.54 +/- 2.02, while for children in public schools it was 2.48 +/- 2.51. The prevalence of fluorosis was 60.8% and 49.9% respectively, in accordance with the previous results.

These results were statistically significant (p<0.05). Carious surfaces were observed in a larger number of participants in this research from public schools.

Waltimo et al.[17] in 2011 followed the frequency of caries in children from Basel-Landschaft Canton, Switzerland, aged 7, 12 and 15 years, over a 20-year period from 1992 to 2011. During this research, they determined that the overall caries frequency decreased from 1992 to 2006 but increased later again. In 2011, the average structure of the DMF-index was 0.83, while 63% of the children were caries-free.

Davidović et al.[18] conducted a study to determine the dental health of children aged 12 and 15 living in the cities of Foča, Čajnice and Kalinovik in Bosnia and Herzegovina. A total of 506 students were included in the research and the following results were obtained: the DMF-index was 6.17, and caries (decay) was registered in 96.05% of the examined children. The prevalence rate of the decay-index was 23.04%. These findings are very similar to our study. To compare the data, we analyzed the structure of the DMF-index with localization in Tetovo and Gostivar in Tables 7 and 8 in order to compare them with the data from Table 9 and 10.

First, we divided the decayed teeth, the missing teeth and the filled teeth among the pupils from male gender in the municipalities of Tetovo and Gostivar. We then conducted the statistical analysis with usage of the descriptive analysis, t-test, mean value and test of significance.

The same statistical operations were performed for the pupils of female gender. This enabled us to discuss several aspects of the structure of the DMF-index for the first permanent molars.

Although there were differences observed in certain parameters when analyzing the overall data between genders, regardless of the city they come from, the statistical analysis of the values among the male gender examinees, considering the place of residence, and among the female gender examinees, did not show significant differences (p>0.05) (tables 7, 8, 9 and 10). However, it is worth noting that the male gender examinees from the municipality of Gostivar had slightly higher mean values for all the examined parameters compared to the male gender examinees from the city of Tetovo. In relation to the female gender examinees, this difference was particularly noticeable for the parameter of filled teeth.

Considering the data from the literature and our everyday clinical practice, we can discuss that over the last forty years, the prevalence of caries, especially in developed countries, has decreased, leading to an improvement in the overall dental health worldwide. This decrease in the prevalence of caries can be attributed to lifestyle changes, dietary improvements, better hygiene practices, widespread application of fluoride prophylaxis and emphasis on the preventive measures.

Conclusion

Based on the obtained results, it can be concluded that age of 12 is a critical and significant period for the implementing preventive-prophylactic measures to maintain the health of the first permanent molars which are biologically and functionally very important teeth. Based on the analysis of the results obtained from this research, it can be concluded that the structure of the DMF-index for the first permanent molars between examinees from the municipalities of Tetovo and Gostivar did not represent statistical significance. The same applies for the percentage of decayed, missing teeth and fillings of the teeth. However, the structure of the DMF-index in terms of gender distribution, shows a statistically significant difference in relation to the filled first permanent molars, which are in greater representation among girl pupils, which can be attributed to their interest in appearance and overall health.

Oral hygiene practices, and dietary habits are correlated with the incidence of caries in the first permanent molars. Insufficient health education, poor oral hygiene, inadequate dietary regime, as well as inadequate fluoride exposure, result in a high percentage of carious first permanent molars. Therefore, it is imperative to implement strengthened preventive measures and procedures, as in the National Strategy for improvement of the oral health of children of the Republic of North Macedonia. These efforts are essential for creating a healthier future population.

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