

## Assessment of gingival status in children aged 10-14 years with full mouth plaque score and full mouth bleeding score index

Hristina Tankova<sup>1</sup>, Nadezhda Mitova<sup>2</sup>, Zornitsa Lazarova<sup>3</sup>

## Оценка на гингивален статус при деца от 10-14 години с индексна система full mouth plaque score u full mouth bleeding score (FMPS u FMBS)

Христина Танкова<sup>1</sup>, Надежда Митова<sup>2</sup>, Зорница Лазарова<sup>3</sup>

### Summary

*The period of mixed dentition is characterized by an increased risk of periodontal disease. The assessment of plaque accumulation and gingival bleeding is essential in the diagnosis of plaque-induced gingivitis.*

**Aim:** *Assessing the gingival status in children aged 10-14 years using an index system for plaque accumulation and gingival bleeding assessing all permanent teeth erupted.*

**Materials and Methods:** *The subject of the study were 457 children aged 10 to 14 years. Assessment of plaque accumulation – full mouth plaque score (FMPS) and gingival inflammation – full mounth bleeding score (FMBS) was performed on each child. Full mouth plaque score was performed without staining on all examined permanent teeth in four surfaces – medial, vestibular, distal and oral. Full mounth bleeding score was performed by the presence of bleeding on probing on all permanent teeth at four points – medial, vestibular, distal and oral. The index shows the relative proportion of plaque surfaces or bleeding on probing for each patient on each sextants and surfaces.*

**Results:** *In children aged 10-14 years, localized forms of plaque-induced gingivitis predominate and the presence of dental biofilm affects 38.5% of the child's dentition. The dental biofilm and gingival inflammation is mainly in the frontal areas of both jaws on the vestibular and proximal tooth surfaces. FMPS / FMBS index system provides a quick and objective assessment of the overall gingival status of children aged 10-14 years.*

**Key words:** *full mouth plaque score, full mouth bleeding score, gingivitis in childhood*

### Резюме

*Периодът на смесено съзъбие се характеризира с повишен риск от пародонтална патология. Оценка на плаконатрупване и провокирано гингивално кървене е от съществено значение в диагностиката на плак-индуцирани гингивити.*

**Цел.** *Оценка на гингивалния статус при деца от 10-14 години чрез индексна система за плаконатрупване и гингивално кървене оценяваща всички пробили постоянни зъби (FMPS, FMBS).*

**Материал и методи.** *Обект на изследването са 457 деца на възраст от 10 до 14 години. Оценка на плаконатрупване – full mouth plaque score (FMPS) и гингивално възпаление – full mounth bleeding*

<sup>1</sup>Assistant, Department of Pediatric Dentistry, Faculty of Dental Medicine, Medical University – Sofia

<sup>2</sup>Associate Professor Department of Pediatric Dentistry, Faculty of Dental Medicine, Medical University – Sofia

<sup>3</sup>Assistant, Department of Pediatric Dentistry, Faculty of Dental Medicine, Medical University – Sofia

<sup>1</sup>Асистент, катедра Детска дентална медицина, Факултет по Дентална медицина, Медицински университет – София

<sup>2</sup>Доцент, катедра Детска дентална медицина, Факултет по Дентална медицина, Медицински университет – София

<sup>3</sup>Асистент, катедра Детска дентална медицина, Факултет по Дентална медицина, Медицински университет – София

score (FMBS) се извършва на всяко дете. Оценката на плаконатрупване е извършена без оцветяване на всички пробили постоянни зъби върху четири повърхности – медиална, вестибуларна, дистална и орална. Оценката на провокирано гингивално кървене се осъществява чрез отчитане наличието на кървене при сондиране на всички постоянни зъби в четири точки – медиална, вестибуларна, дистална и орална. Индексите показват относителния дял на повърхностите с плаката или кървенето при сондиране за всеки пациент на всеки секстант и повърхност.

**Резултати.** При деца на възраст 10-14 години преобладават локализираните форми на плак индуциран гингивит, като плаконатрупването засяга 38,5% от зъбните повърхности на всяко дете. Денталния биофилм и гингивалното възпаление са локализирани главно във фронталните области на двете челюсти по вестибуларните и апроксимални повърхности на зъбите. Индексната система FMPS/FMBS осигурява бърза и обективна оценка на цялостния гингивален статус на деца на възраст 10-14 години.

**Ключови думи:** Full mouth plaque score, full mouth bleeding score, гингивит в детско юношеска възраст.

## Introduction

The period of mixed dentition is characterized by an increased risk of periodontal disease [1]. At this age, children have unstable oral hygiene habits, risky eating, orthodontic anomalies, and hormonal changes characteristic of puberty.

The subgingival microflora, as the main etiological factor of gingival inflammation, is formed after the eruption of permanent teeth with the mediation of microorganisms from the supragingival plaque. In this regard, increased plaque accumulation in the area above the marginal gingiva is a risk factor for the formation of subgingival biofilm [2].

According to the modern classification of periodontal diseases adopted by experts from the American Academy of Periodontology and the European Federation of Periodontology in 2018, gingival health is referred to as bleeding on probing covering less than 10% of the gingiva and a probing depth less than or equal to 3 mm [3].

Murakami and Mariotti propose the term “initial gingivitis” which includes single sites affected by a mild inflammatory reaction with no edema and bleeding on probing. The authors believe that this “initial gingivitis” may be an option of gingival health, but if left untreated, it will inevitably lead to the development of generalized gingival inflammation [4].

In childhood, these early stages of gingival inflammation are particularly important and should not be neglected, but should be recorded in the gen-

eral preventive dental examination and be subject to periodontal prevention, which aims to prevent the occurrence or aggravation of the inflammatory reaction in the periodontium.

Clinically established gingivitis is considered to be a “site-specific” inflammation of the gingiva caused by the bacterial biofilm. It is characterized by edema, redness of the marginal gingiva, in the absence of bone destruction [5, 6]

Clinical methods for assessment of gingival inflammation are based on visual assessment of the changes covering its marginal part. In addition to the change in its contour, color and consistency the bleeding on probing (BOP) is also essential for assessing the gingival status, which is considered an objective, accurate and easily applicable method for assessing the location of gingival inflammation in the respective child. [7, 8].

Gingival Index by Loe & Silness (GI), Sulcus bleeding index (SBI) and Papillary bleeding index (PBI), traditionally used in diagnostics, report bleeding on probing with the help of a periodontal probe. The disadvantage of the listed indices is their relatively complicated protocol of work, reporting of subjective changes in the gingiva, as well as the extended registration time. In contrast to the mentioned indices, full mouth bleeding score (FMBS) [9] shows some advantages – reduced time for data registration, as well as reporting only the presence of bleeding on probing sufficient for diagnosis.

**Aim:**

The aim of the present study was to assess the gingival status in children aged 10-14 years using an index system for plaque accumulation and gingival bleeding assessing all permanent teeth erupted.

**Materials and Methods:**

The subject of the study were 457 children aged 10 to 14 years.

The study was conducted in two Sofia schools. The children were divided into five groups according to age – 10, 11, 12, 13, and 14 years old.

Criteria for inclusion of children in the study were: (1) informed consent signed by the parents for participation in the scientific study approved by KENIMUS with protocol No 12/14.05.2020; (2) lack of systemic disease or drug therapy; (3) lack of non-removable orthodontic appliances;

**Methodology**

The children included in the study were evenly distributed by sex – 234 girls and 223 boys. There were an average of 90 people in each age group.

All children were clinically examined and the data was recorded in a specially designed card. The clinical trial was performed by one dentist in a clinical office. Disposable examination instruments and a mechanical periodontal probe were used, and the data was recorded with the participation of a dental assistant.

In view of the purpose of the study of each child, the following were performed:

– Assessment of plaque accumulation – full mouth plaque score (FMPS) [10], and

– Assessment of gingival inflammation – full mouth bleeding score (FMBS).

The registration of the full mouth plaque score index (FMPS) was performed without staining, using a mechanical periodontal probe (WHO 621), on all examined permanent teeth in four surfaces – medial, vestibular, distal and oral. The probe is passed along the vestibular surface of the tooth from distal to medial and is monitored for plaque on tip of the

probe; the same technique is used for the oral surface. The index takes into account the presence of plaque accumulation and shows the percentage distribution of plaque surfaces for each patient.

The calculation of the patient index included the sum of all plaque surfaces divided by the total number of surfaces examined. The same calculation was performed on sextants and on surfaces - vestibular, proximal and oral.

An assessment of gingival inflammation – full mouth bleeding score (FMBS) was performed using a mechanical periodontal probe, recording the presence of BOP on all permanent teeth at four points – medial, vestibular, distal and oral. The tip of the probe penetrates about 1 mm into the gingival sulcus at certain points without reaching its bottom, after which the probe is removed and monitored for bleeding for the next 10 seconds. The index shows the percentage of gingival bleeding for each patient.

The calculation of the index included the sum of all bleeding points divided by the total number of points studied. The same calculation was performed on sextants and on surfaces.

SPSS Windows, version 19.0 was used for statistical data processing. The tests used were:

– Descriptive analysis – tabular and graphical representation of the distribution of variables - absolute and relative frequencies;

– Correlation analysis – for quantitative assessment of the relationship between the studied traits;

– Alternative T analysis – to compare relative shares;

**Results****1. Assessment of the presence of dental biofilm by full mouth plaque score (FMPS)****1.1. Relative share of dental surfaces with plaque registered by the FMPS index, distributed by age**

The following table shows the relative share of dental surfaces with plaque in different age groups (Table 1).

Table 1. FMPS plaque index by age

Age	Plaque surfaces		Plaque-free surfaces		Total	
	n	% ± SP	n	%	n	%
10 year olds - 99 children	3650	51,4 ± 0,59	3450	48,6	7100	100
11 year olds -97 children	4032	44,1 ± 0,52	5112	55,9	9144	100
12 year olds -89 children	3713	39,6 ± 0,51	5663	60,	9376	100
13 year olds -92 children	2905	29,1 ± 0,45	7111	70,9	10016	100
14 year olds -80 children	2267	25,3 ± 0,46	6693	74,7	8960	100
Total-457 children	16567	38,5	28029	61,5	44596	100
Alternative analysis	T <sub>10,11</sub> =9,28 p<0.05		T <sub>10,14</sub> =34,80 p<0.05		T <sub>11,14</sub> =27,11 p<0.05	
T-test	T <sub>11,12</sub> =6,20 p<0.05		T <sub>10,12</sub> =15,16 p<0.05		T <sub>12,13</sub> =15,61 p<0.05	
	T <sub>11,13</sub> =21,89 p<0.05		T <sub>10,13</sub> =30,01 p<0.05		T <sub>12,14</sub> =20,95 p<0.05	
	T <sub>13,14</sub> =5,74 p<0.05					

The table shows that the prevalence of the index in all examined children is 38.5% on average, which shows that 1/3 of the examined surfaces have plaque. The highest value of the index is observed in 10-year-old children -51.4% of the surfaces in these children are with plaque, which is probably due to unacquired oral hygiene habits and the presence of primary teeth. As the age of the children increases, there is a progressive decrease in plaque accumulation.

### 1.2. Relative share of dental surfaces with plaque registered by the FMPS index, by sextants

The following table shows the relative share of dental surfaces with plaque by sextants (Table 2).

The table shows that the largest presence of plaque is found in the II and V sextant (upper and

lower frontal area) – 51%. The presence of plaque in the lateral areas of the lower jaw (IV and VI sextant) shows the lowest values – 26%, which are almost twice as small as in the frontal segment of both jaws ( $p < 0.05$ ).

### 1.3. Relative share of dental surfaces with plaque registered by the FMPS index by type of affected surfaces

The following table shows the average values of the FMPS index by surfaces (Table 3).

The table shows that the registered dental surfaces with plaque are proximal and vestibular, and evenly distributed. There is a minimum number of oral surfaces with the presence of dental plaque in all examined children, which affects the average values of the index for the child, reducing it significantly.

Table 2. Plaque index FMPS by sextants

Sextant	Plaque surfaces		Plaque-free surfaces		Total	
	n	% ± SP	n	%	n	%
I Sextant <sup>1</sup>	1724	31% ± 0,62	3836	69%	5560	100%
II Sextant <sup>2</sup>	5208	51% ± 0,49	5004	49%	10212	100%
III Sextant <sup>3</sup>	2462	40% ± 0,62	3694	60%	6156	100%
IV Sextant <sup>4</sup>	1602	26% ± 0,56	4558	74%	6160	100%
V Sextant <sup>5</sup>	4808	45% ± 0,48	5876	55%	10684	100%
VI Sextant <sup>6</sup>	1617	27% ± 0,57	4371	73%	5988	100%
Alternative analysis	t <sub>1,2</sub> =25,02 p <sub>1,2</sub> <0.05		t <sub>2,6</sub> = 31,67 p <sub>2,6</sub> <0.05		t <sub>1,6</sub> = 4,74 p <sub>1,6</sub> <0.05	
T-test	t <sub>1,3</sub> =10,21 p <sub>1,3</sub> <0.05		t <sub>3,4</sub> = 16,69 p <sub>3,4</sub> <0.05		t <sub>2,3</sub> =13,82 p <sub>2,3</sub> <0.05	
	t <sub>1,4</sub> = 5,99 p <sub>1,4</sub> <0.05		t <sub>3,5</sub> = 6,35 p <sub>3,5</sub> <0.05		t <sub>1,5</sub> =17,82 p <sub>1,5</sub> <0.05	
	t <sub>2,4</sub> = 33,48 p <sub>2,4</sub> <0.05		t <sub>5,6</sub> = 24,05 p <sub>5,6</sub> <0.05		t <sub>4,5</sub> =25,75 p <sub>4,5</sub> <0.05	
					t <sub>4,6</sub> =1,25 p <sub>4,6</sub> >0.05	
						t <sub>3,6</sub> = 15,32 p <sub>3,6</sub> <0.05

**Table 3.** FMPS plaque index on surfaces

Localization	n	% ± SP	Statistics	
Vestibular <sup>1</sup>	4924	44% ± 0,47	t <sub>1,2</sub> = 0,21 t <sub>1,3</sub> = 70,14 t <sub>2,3</sub> = 97,18	p <sub>1,2</sub> > 0.05 p <sub>1,3</sub> < 0.05 p <sub>2,3</sub> < 0.05
Proximal <sup>2</sup>	10519	47% ± 0,33		
Oral <sup>3</sup>	783	7% ± 0,24		

**2. Assessment of gingival bleeding by gingival index – full mouth bleeding score (FMBS)**

**2.1. Relative share of bleeding points registered by the FMBS index, broken down by age**

The following table shows the relative share of bleeding points in different age groups (Table 4).

The table shows that the average value of the index in all examined children is 18% ± 0.40. The

values for bleeding on probing decrease twice in 14-year-old children, while in other ages the values of the index are approximately the same.

**2.2. Grouping of children according to the values of FMBS – index**

The following table shows the distribution of children according to the index for gingival bleeding FMBS, grouped into 3 groups (Table 5)

**Table 4.** Gingival bleeding FMBS by age

Age	Bleeding points		Non-bleeding points		Total	
	n	% ± SP	n	%	n	%
10 year olds -99 children	1562	22% ± 0,49	5538	88%	7100	100%
11 year olds -97 children	1646	18% ± 0,40	7498	82%	9144	100%
12 year olds -89 children	1782	19% ± 0,41	7594	81%	9376	100%
13 year olds -92 children	2103	21% ± 0,41	7913	79%	10016	100%
14 year olds -80 children	896	10% ± 0,32	8064	90%	8960	100%
Total-457 children	8027	18% ± 0,18	36569	82%	44596	100%
Alternative analysis	T <sub>10,11</sub> = 6,30	p < 0.05	T <sub>11,12</sub> = 1,76	p > 0.05	T <sub>12,14</sub> = 17,51	p < 0.05
T-test	T <sub>10,12</sub> = 4,70	p < 0.05	T <sub>11,13</sub> = 5,24	p < 0.05	T <sub>13,14</sub> = 5,74	p < 0.05
	T <sub>10,13</sub> = 1,57	p > 0.05	T <sub>11,14</sub> = 15,63	p < 0.05		
	T <sub>10,14</sub> = 20,52	p < 0.05	T <sub>12,13</sub> = 3,47	p < 0.05		

**Table 5.** Grouping of children according to FMBS – index

	FMBS distribution									
	Up to 10%		Up to 30%		Between 30 and 50%		Above 50%		Total	
	n	%	n	%	n	%	n	%	n	%
Total	163	35,7	182	39,8	91	19,9	21	4,6	457	100

Contingency Coefficient = 0,331 Sig = 0,000

The table shows that about 1/3 of all children have an index value of up to 10%, which characterizes gingival health. The data also demonstrates that 2/3 of the examined children have a value of BOP from 0% to 30%, which according to the modern classification of periodontal diseases, is considered a localized form of plaque-associated gingivitis. Bleeding on probing between 30 and 50%, which is identified with a generalized form of gingival inflammation, is found in 1/4 of the examined children.

### 2.3. Relative share of bleeding points registered by the FMBS index, broken down by sextants

The following table shows the relative share of bleeding points by sextants (Table 6).

The table shows that the highest values of the index are reported in the II and V sextant – 32%, which corresponds to the presence of inflammation in the frontal areas of the upper and lower jaw. In the other sextants, the values for BOP are approximately the same, but three times lower than those in the front.

### 2.4. Relative share of registered gingival bleeding points by the FMBS index, distributed by surfaces

The following table shows the distribution of the FMBS index by surfaces (Table 7).

The data in the table indicates that most gingival bleeding is found on the proximal surfaces of the examined teeth and a twofold decrease in bleeding on the vestibular surfaces compared to the proximal ones. Insignificant bleeding is found on the oral surfaces, which, as with the oral hygiene index, is the probable reason for a general decrease in values in the examined children.

3. Correlation between relative proportion of dental surfaces with plaque and bleeding on probing studied with index system FMPS and FMBS

The following table presents the correlation between the FMPS plaque index and the FMBS gingival bleeding index in the different age groups (Table 8).

It is clear from the table that there is a moderately proportional relationship between the two indices ( $r = 0.582$   $p < 0.05$ ), which shows that as the values of the plaque index decrease, the values for BOP decrease. The highest percentage of plaque surfaces is found in 10-year-old children, and the same is observed in the percentage of bleeding points. It is clear that plaque decreases gradually with age, while BOP values remain approximately the same and double in 14-year-olds. On the other hand, it is noteworthy that there is twice the percentage of gingival bleeding in a child compared to the percentage of dental surfaces with plaque in all children studied.

*Table 6. Gingival bleeding FMBS by sextants*

Sextant	% ± SP	Alternative analysis T-test			
I Sextant <sup>1</sup>	7% ± 0,34	$t_{1,2}=40,49$	$p_{1,2}<0.05$	$t_{2,6}=41,02$	$p_{2,6}<0.05$
II Sextant <sup>2</sup>	30% ± 0,45	$t_{1,3}=2,05$	$p_{1,3}<0.05$	$t_{3,4}=4,32$	$p_{3,4}<0.05$
III Sextant <sup>3</sup>	8% ± 0,35	$t_{1,4}=2,17$	$p_{1,4}<0.05$	$t_{3,5}=42,24$	$p_{3,5}<0.05$
IV Sextant <sup>4</sup>	6% ± 0,30	$t_{1,5}=44,15$	$p_{1,5}<0.05$	$t_{3,6}=2,08$	$p_{3,6}<0.05$
V Sextant <sup>5</sup>	32% ± 0,45	$t_{1,6}=0$	$p_{1,6}$	$t_{4,5}=47,83$	$p_{4,5}<0.05$
VI Sextant <sup>6</sup>	7% ± 0,33	$t_{2,3}=38,59$	$p_{2,3}<0.05$	$t_{4,6}=2,21$	$p_{4,6}<0.05$
		$t_{2,4}=44,00$	$p_{2,4}<0.05$	$t_{5,6}=44,74$	$p_{5,6}<0.05$
		$t_{2,5}=3,14$	$p_{2,5}<0.05$		

*Table 7. Gingival bleeding FMBS on surfaces*

Localization	n Number of bleeding points	% ± SP	Alternative analysis T-test	
Vestibular <sup>1</sup>	2686	24% ± 0,40	$t_{1,2}=43,91$	$p_{1,2}<0.05$
Proximal <sup>2</sup>	10519	47% ± 0,33	$t_{1,3}=51,78$	$p_{1,3}<0.05$
Oral <sup>3</sup>	224	2% ± 0,13	$t_{2,3}=125,37$	$p_{2,3}<0.05$

**Table 8.** Correlation between FMPS and FMBS index by age

Age	FMPS	FMBS	Pearson correlation
	% plaque surfaces	% bleeding points	
10 year olds	51%	22%	r=0.522 p<0.05
11 year olds	44%	18%	r=0.615 p<0.05
12 year olds	39%	19%	r=0.522 p<0.05
13 year olds	29%	21%	r=0.747 p<0.05
14 year olds	25%	10%	r=0.591 p<0.05
Total	38,5%	18%	r=0.582 p<0.05

### Discussion

The present study found that in children aged 10-14 years on average – 38.5% of the examined dental surfaces have plaque registered by FMRS. With aging, there is a reduction of dental surfaces with plaque, probably due to improved oral hygiene habits of children, as well as the replacement of mixed with completely permanent dentition. According to the localization of the dental biofilm, we found that most plaque is registered in the frontal area of both jaws, involving mainly the proximal and vestibular tooth surfaces. Funieru et al received similar results as part of an epidemiological study on children conducted in 2017 [11].

There are various index systems (PL, OHI-S) for the assessment of plaque accumulation, and for the purposes of epidemiology, those assessing the presence of plaque on representative teeth are usually used. The FMPS index detects the presence of plaque on all tooth surfaces without taking into account its amount. This allows the examination to be performed faster, which on the one hand is comparable to the examination time using indices on representative teeth, and on the other hand allows for a comprehensive assessment of the dentition.

Assessment of gingival status by FMBS in children aged 10-14 years showed that an average of 18% of the dentition is affected by BOP in the gingiva, which gives us reason to conclude that at this age there are mostly localized and mild forms of gingival inflammation. Most likely, the relatively low values of FMBS are also due to examination of the oral gingival surfaces, which are generally less commonly affected by inflammation. Here, as with FMRS, the gingival status of the entire dentition is

registered. Contrary to our results, a group of authors found about 52% gingival bleeding, which is probably due to the fact that the authors examine only the vestibular surfaces of permanent teeth [12].

The present study did not detect the presence of plaque-induced systemic factor-modified gingivitis as well as other forms of severe gingival inflammation.

The advantage of the index system we use compared to the traditionally used ones (GI, CPITN, PBI) is that the work protocol is simple and relatively fast, while proving a general insight on the overall oral hygiene and gingival status of the patient. It is the assessment of the entire dentition that is the focus of the modern concept of “site-specific inflammation” in the gingiva and makes the index suitable for use in epidemiological studies in children in whom the inflammation is localized and most often in the initial severity.

By correlation analysis, we found that plaque accumulation has a directly proportional effect on gingival inflammation. Despite the established correlation, it is noticeable that in all age groups the relative share of dental surfaces with plaque is almost twice as large as the relative share of places with bleeding points. The reason for this probably lies in the need for a certain amount of plaque and the subsequent change in the bacterial ecology in order to manifest clinically detectable gingival inflammation.

The specifics of childhood, as well as the use of different index systems for assessing gingival health are the reason for the diverse results obtained by different authors for plaque accumulation and gingival inflammation at this age [13, 14, 15, 16]. A scientific study in 12-year-old children comparing the diagnosis on representative teeth and on the entire dentition

found that the assessment of only a few points in two of the quadrants of the dentition did not lead to a significant loss of information about periodontal status [17]. However, in view of the preventive approach and the modern concept of periodontal pathology, we believe that the study of the entire dentition provides more complete and accurate information about gingival health in childhood and adolescence.

### Conclusions:

1. In children aged 10-14 years, localized forms of plaque-induced gingivitis are predominant, covering about 18% of the child's dentition.

2. For children aged 10-14 years the presence of dental biofilm affects 38.5% of the child's dentition.

3. The dental biofilm is mainly in the frontal areas of both jaws on the vestibular and proximal tooth surfaces.

4. The degree of gingival inflammation is directly dependent on the degree of plaque accumulation.

5. The FMRS/FMBS index system provides a quick and objective assessment of the overall gingival status of children aged 10-14 years.

The publication is under the Grant 2020 project with CONTRACT № 113/24.06.2020. on the topic "Epidemiology, diagnostics, treatment and prevention of plaque-induced gingivitis in childhood and adolescence"

### References:

1. M Rashkova M. Periodontal diseases in children and adolescents. Sofia: Direct Services; 2016.
2. Carranza FA. Classification of diseases of the periodontium. In: Carranza FA and Newman MG. Clinical Periodontology. 10th ed. Philadelphia: W.B. Saunders Company 2006:58-81.
3. Trombelli L, Farina R, Silva CO, Tatakis DN. Plaque-induced gingivitis: Case definition and diagnostic considerations. *J Clin Periodontol.* 2018 Jun;45 Suppl 20:S44-S67. doi: 10.1111/jcpe.12939. PMID: 29926492..
4. Murakami S, Mealey BL, Mariotti A, Chapple ILC. Dental plaque-induced gingival conditions. *J Periodontol.* 2018 Jun;89 Suppl 1:S17-S27. doi: 10.1002/JPER.17-0095. PMID: 29926958.
5. LOE H, THEILADE E, JENSEN SB. EXPERIMENTAL GINGIVITIS IN MAN. *J Periodontol.* 1965 May-Jun;36:177-87. doi: 10.1902/jop.1965.36.3.177. PMID: 14296927.
6. American Academy of Periodontology. Parameter on plaque-induced gingivitis. *J Periodontol.* 2000;71(5 Suppl):851-852.
7. Caton JG, Armitage G, Berglundh T, Chapple ILC, Jepsen S, Kornman KS, Mealey BL, Papananou PN, Sanz M, Tonetti MS. A new classification scheme for periodontal and peri-implant diseases and conditions - Introduction and key changes from the 1999 classification. *J Clin Periodontol.* 2018 Jun;45 Suppl 20:S1-S8. doi: 10.1111/jcpe.12935. PMID: 29926489..
8. Lang NP, Bartold PM. Periodontal health. *J Periodontol.* 2018 Jun;89 Suppl 1:S9-S16. doi: 10.1002/JPER.16-0517. PMID: 29926938.
9. Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. *Int Dent J.* 1975 Dec;25(4):229-35. PMID: 1058834.
10. O'Leary TJ, Drake RB, Naylor JE. The plaque control record. *J Periodontol.* 1972 Jan;43(1):38. doi: 10.1902/jop.1972.43.1.38. PMID: 4500182.
11. Funieru C, Klinger A, Băicuș C, Funieru E, Dumitriu HT, Dumitriu A. Epidemiology of gingivitis in schoolchildren in Bucharest, Romania: a cross-sectional study. *J Periodontol Res.* 2017 Apr;52(2):225-232. doi: 10.1111/jre.12385. Epub 2016 Apr 19. PMID: 27093564.
12. Aboubacar Sidiki Thissé Kane, Amsalla Niang: Prevalence of Gingivitis among Malian Children. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada* 2018, 18(1):e4129
13. Australian Research Centre for Population Oral Health, The University of Adelaide, South Australia. Periodontal diseases in the Australian adult population. *Aust Dent J.* 2009 Dec;54(4):390-3. doi: 10.1111/j.1834-7819.2009.01167.x. PMID: 20415940.
14. SHAZIA PARVEEN RAJPAR: GINGIVITIS AMONG 8-15 YEARS OLD CHILDREN IN LUMHS, DENTAL OPD, JAMSHORO. *Pakistan Oral & Dental Journal* Vol 36, No. 3 (July-September 2016).
15. Curilović Z, Mazor Z, Berchtold H. Gingivitis in Zurich schoolchildren. A reexamination after 20 years. *SSO Schweiz Monatsschr Zahnheilkd.* 1977 Aug;87(8):801-8. PMID: 272052.
16. Kaur A, Gupta N, Baweja DK, Simratvir M. An epidemiological study to determine the prevalence and risk assessment of gingivitis in 5-, 12- and 15-year-old children of rural and urban area of Panchkula (Haryana). *Indian J Dent Res.* 2014 May-Jun;25(3):294-9. doi: 10.4103/0970-9290.138310. PMID: 25098983.
17. Ediani Machado M, Tomazoni F, Ruffo Ortiz F, Ardenghi TM, Zanatta FB. Impact of Partial-Mouth Periodontal Examination Protocols on the Association Between Gingival Bleeding and Oral Health-Related Quality of Life in Adolescents. *J Periodontol.* 2017 Jul;88(7):693-701. doi: 10.1902/jop.2017.160622. Epub 2017 Feb 26. PMID: 28398112.

### Address for correspondence:

Dr. Hristina Tankova  
 Department of Pediatric Dental Medicine  
 Faculty of Dental Medicine, MU – Sofia  
 1 „St.G. Sofiyski“ blvd.  
 1431 Sofia, Bulgaria  
 phone number: 00359887243099  
 e-mail: h.tankova@fdm.mu-sofia.bg