Use of Cariogram as a risk assessment of caries lesions in the city of Arraial do Cabo, Brazil

Uso do Cariograma como avaliação de risco de lesões de cárie na cidade de Arraial do Cabo, Brasil

DOI:10.34117/bjdv7n2-054

Recebimento dos originais: 10/01/2021
Aceitação para publicação: 04/02/2021

Caroline Lourenço Correia
MSc, School of Dentistry, Federal Fluminense University
R. Mario Santos Braga, 30, Centro, Niterói, RJ, Zip code 24020-140, Brazil
E-mail: caroline@dentistas.com.br

João Victor Frazão Câmara
MSc student, Department of Biological Sciences, Bauru School of Dentistry, University of São Paulo
Alameda Dr. Octávio Pinheiro Brisolla, 9-75, Vila Universitária, Bauru, SP, Zip code 17011-220, Brazil
E-mail: jvfrazao92@hotmail.com

Gisele Damiana da Silveira Pereira
Associate Professor, Department of Dental Clinic, School of Dentistry, Federal University of Rio de Janeiro
R. Professor Rodolpho Paulo Rocco, 325, Cidade Universitária, Rio de Janeiro - RJ, Zip code 21941-617, Brazil
E-mail: giseledamiana@yahoo.com

Isabel Ferreira Barbosa
PhD, Piracicaba School of Dentistry, State University of Campinas
Av. Limeira, 901, Areião, Piracicaba, SP, Zip code 13414-903, Brazil
E-mail: barbosa.isabelferreira@gmail.com

Josué Junior Araujo Pierote
PhD, Piracicaba School of Dentistry, State University of Campinas
Av. Limeira, 901, Areião, Piracicaba, SP, Zip code 13414-903, Brazil
E-mail: josuepierote@hotmail.com

Justine Monteiro Monnerat Tinoco
Adjunct Professor, Department of Dental Clinic, School of Dentistry, Federal University of Rio de Janeiro
R. Professor Rodolpho Paulo Rocco, 325, Cidade Universitária, Rio de Janeiro - RJ, Zip code 21941-617, Brazil
E-mail: justinemonnerat@yahoo.com.br

Amara Eulalia Chagas Santos
Associate Professor, Department of Dental Clinic, School of Dentistry, Federal University of Rio de Janeiro

R. Professor Rodolpho Paulo Rocco, 325, Cidade Universitária, Rio de Janeiro - RJ, Zip code 21941-617, Brazil
E-mail: dra_amara.eulalia@yahoo.com.br

Sonia Groisman
Titular Professor, Department of Social and Preventive Dentistry, School of Dentistry, Federal University of Rio de Janeiro
R. Professor Rodolpho Paulo Rocco, 325, Cidade Universitária, Rio de Janeiro - RJ, Zip code 21941-617, Brazil
E-mail: sonia@dentistas.com.br

ABSTRACT
The aim of this study was to establish a caries risk profile for the population served in the Family Health Program in the city of Arraial do Cabo, Rio de Janeiro, comparing the Cariogram results when using DMF-T and ICDAS. 165 individuals divided into different age groups were evaluated by 1 examiner. The factors evaluated were caries experience, systemic diseases, diet (content and frequency), amount of plaque, fluoride program, salivary secretion and clinical evaluation of the evaluator. Was used the SPSS software, version 17.0, to perform the work and adopted the significance level of 1% and 5% probability (P <0.050). Chances in avoiding caries were observed according etiological factors evaluated. DMF-T/dmf-t and ICDAS predominant score was 3, DMF-T value was 9.44, and ICDAS was 11,9. The chances to prevent carious lesions showed a statistical difference at 1 %: diet content (p = 0.000) and its frequency (p = 0.000), presence of biofilm (p = 0.00), and fluorides (p = 0.000). When DMF-T was used to access caries, cariogram preventive measures proposed type 2 (high risk for caries - 34,5 %). With ICDAS, 37.6 %, of the proposals where for the type 2 and 38.2 % for type 3. The Cariogram showed more risk factors for the occurrence of carious, concerning content of diet and presence of biofilm, proposing a more intensive preventive program when ICDAS was used.

Key words: Dental caries; Dental Caries Susceptibility; Dental Caries Activity Tests.

RESUMO
O objetivo deste estudo foi estabelecer um perfil de risco de cárie para a população atendida no Programa de Saúde da Família na cidade de Arraial do Cabo, Rio de Janeiro, comparando os resultados do Cariograma ao utilizar o DMF-T e o ICDAS. 165 indivíduos divididos em diferentes faixas etárias foram avaliados por 1 examinador. Os fatores avaliados foram experiência de cárie, doenças sistêmicas, dieta (conteúdo e frequência), quantidade de placa bacteriana, programa de fluoreto, secreção salivar e avaliação clínica do avaliador. Foi utilizado o software SPSS, versão 17.0, para realização do trabalho e adotado o nível de significância de 1% e 5% de probabilidade (P <0,050). As chances de prevenir a cárie foram observadas de acordo com os fatores etiológicos avaliados. O escore predominante do DMF-T/dmf-t e ICDAS foi 3, o valor do DMF-T foi 9,44 e o ICDAS foi 11,9. As chances de prevenção de lesões de cárie apresentaram diferença estatística em 1%: conteúdo da dieta (p = 0,000) e frequência (p = 0,000), presença de biofilme (p = 0,00) e fluoretos (p = 0,000). Quando o DMF-T foi utilizado para avaliar a cárie, medidas preventivas de cariograma propuseram o tipo 2 (alto risco de cárie - 34,5%). Com o ICDAS, 37,6%, das propostas foram para o tipo 2 e 38,2% para o tipo 3. O Cariograma mostrou mais fatores de risco para a ocorrência de cárie, quanto ao

conteúdo da dieta e presença de biofilme, propondo um programa preventivo mais intensivo quando o ICDAS foi usado.

Palavras-chave: Cárie Dentária; Suscetibilidade à Cárie Dentária; Testes de Atividade de Cárie Dentária

1 INTRODUCTION

Dental caries is a complex multifactorial disease, involving interactions among the tooth structure, oral microbial biofilm formed on the tooth surface, dietary carbohydrates, mainly sugars and to a less extent starches, and salivary and genetics influence.[1] According to FDI data, 35% of the population presents untreated caries in permanent teeth.[2] This is a global public health problem that affects oral and systemic health of an individual.

The caries risk assessment can be determined by Cariogram (Cariogram®, Faculty of Dentistry, Malmö, Sweden), a computer program developed for educational, preventive and clinical aiming to optimize the practical application of caries risk assessment. This software considers different risk factors involved in caries etiology, which are diet, bacteria, susceptibility, and circumstances. It use, with a reduced model, without the use of salivary tests, has also being proved to be effective.[3,4]

The index of tooth decay prevalence, DMFT (decayed, missed, filled) and the International Caries Detection and Assessment System (ICDAS) are factors that need to be assessed in patients to allow estimation of the possibility or not to develop tooth decay.[5]

The city of Arraial do Cabo (RJ) has a population of 27,715 inhabitants, without water fluoridation program. The city is covered by Family Health Strategy, so the oral health network has 16 dentists, distributed in 6 Family Clinics, and 1 Specialized Center for Dentistry. Arraial do Cabo requires the implementation of an oral health promotion program, the use of Cariogram becomes a valuable analytical tool for the study of future preventive actions in the city. The aim of the study was to establish a caries risk profile for the population served in the Family Health Program in the city of Arraial do Cabo, Rio de Janeiro, comparing the Cariogram results when using DMF-T and ICDAS.

2 MATERIALS AND METHODS

This study was conducted in the city of Arraial do Cabo, Rio de Janeiro, Brazil. The sample consisted of 165 individuals, where 72 (43.6%) were male and 93 (56.4 %) were female. The encompassed age groups were the same as recommended by the National Assessment (SB Brazil 2010): 5 years, 12 years, 15-19 years old, 35-44 years old and 65-74 years old.

After approval in the ethics committee (Medicine School of Federal Fluminense University - Reference no. 458.867), and the signing of the informed consent form, clinical examinations and interviews were conducted, which were inserted into Cariogram Program 3.0 (Departament Malmö University Swden).

Have been raised all the factors that make up the assessment needed for the use of Cariogram without salivary tests, they are: caries experience DMFT and ICDAS, systemic diseases, diet (content and frequency, through diet questionnaires), amount of biofilm, through the Silness-Loe index, fluoride program and salivary secretion flow.

The factors included in Cariogram have "weights" different , this means that the determinants that contribute to the development or resistance to caries, have a greater impact than the less important factors when the program calculates the "likely to prevent new cavities". The factors are also "heavy" relative to each other.

The factors have weights ranging from 0 to 3 or 0 to 2, then individual data obtained were inserted in the same Cariogram® 3.0 program (Departament Malmö University Sweden). Taking into consideration data from the last epidemiological survey, SB Brazil 2010, Rio de Janeiro, where the average DMFT index was 9.72, this calculation was obtained by adding the DMF values of the age groups, divided by the amounts of age groups analyzed, conducted by the author of this work.

Thus, as the Cariogram the manual, the risk of caries, the classification state/country, was low. However, in the case of the city of Arraial do Cabo, which has no fluoridation of public water supplies and oral health program still being established, the same risk was rated high for the sample group. All data were evaluated and classified according to the Cariogram manual. The clinical evaluation is automatically pre-set by the program itself to the value 1.[6] This value that other factors no longer express the "chance to avoid further cavities" according to the program. Therefore it was decided not to change the scores of clinical evaluation of the examiner keeping always worth 1, just to standardize so that all express factors similarly the "chances of avoiding new cavities".

Statistical analyzes were calculated: arithmetic averages, standard deviations, medians, minimum and maximum values of continuous variables, as compared discrete variables were employed distributions of simple frequencies and percentages divided by age groups. Was used the SPSS software, version 17.0, to perform the work and adopted the significance level of 1% and 5% probability (P <0.050). The differences between the use of Cariogram, measured by the DMF and ICDAS statistically tested non-parametric by Kruskal-Wallis and Mann-Whitney. The city of Arraial do Cabo received an individualized report on the treatment needs and each person was properly instructed on their oral health condition, besides having been proposed a program for the group of higher risk individuals of involvement of future carious cavities.

3 RESULTS

The 165 subjects were evaluated and the frequency distribution was carried out of the different factors recommended by Cariogram in the total sample, female and male. Regarding the classification caries experience there was a predominance of score 3 (worse than normal), the disease factor prevalence was the score 0 (no disease), in relation to the content, the score 2 (containing moderate sugar) was the most prevalent within the sample, similar to the frequency that presented the score 2 (maximum 7 meals a day) with greater prevalence. When biofilm was the factor studied the displayed dominance was the score 2 (regular oral hygiene), considering fluorides, score 2 (use only toothpaste) was also the dominant value in the sample, and the factor saliva score 0 (salivary secretion normal).

The sample was classified into five risk groups to prevent further injury: Very high risk (0-20 %), high risk (21-40%), intermediate risk (41-60%), relatively low risk (61-80%) and low risk (81-100%) as shown in table 1.

Table 1: Evaluation table of carious injury risk in male and female.

Carious injury risk	Total	Male	Female
Very high risk 0 - 20%	9,30%	11,10%	7,50%
High risk 21 - 40%	34,50%	30,60%	37,60%
Intermediate risk 41 -60%	38,80%	40,30%	37,60%
Relatively low 61 - 80%	16,95%	16,70%	17,20%
Low risk 81 - 100%	0,70%	1,40%	0%

In the total sample and in the male group intermediate risk was what prevailed, however the female intermediate risk and high risk had similar prevalence. Figures 1 and

2 are examples of two patients with low risk and very high risk, where the first patient has 74 % chance to avoid further injury (low risk), and the second 13% (very high risk).

In the general sample when compared to the probability of avoiding tooth decay using the DMFT / dmft index, factors that presented statistical difference around 1% were: diet content (p = 0.000), dietary frequency (p = 0.000), (p = 0.000) and fluoride (p = 0.000) and the factor that presented statistical difference around 5% was saliva (p = 0.023) (Table 2).

Table 2: Arithmetic means, standard deviations, medians, minimum and maximum values, non-parametric Kruskal-Wallis test, and their significance and multiple comparisons of the study parametric parameters, according to the probability of avoiding tooth decay to the DMFT/dmft percentage of the total sample.

Variables	Arithmetic mean	Standard deviation	Medium	Minimum	Maximum	Test - (P)	Multiple comparisons
Tooth decay 0 1 2	 44,86 42,12 37,93	 17,26 19,27 17,34	 44,0 42,0 39,5	 12 9 14	 87 81 63	 H =2,21 (P=0.331) n.s	-
Diet composition 0 1 2 3	 59,43 50,90 39,18 21,67	 10,85 13,43 18,21 2,08	 63,0 53,5 37,0 21,0	 45 22 9 20	 74 78 87 24	 H=27,64 (P=0.000)**	0 x 2 (P=0.004)** 0 x 3(P=0.017)** 1 x 2 (P=0.000)** 1 x 3(P=0.000)** 2 x 3(P=0.039)*
Frequency 0 1 2 3	 62,50 55,09 41,67 24,94	 9,19 16,00 15,27 13,60	 62,5 55,0 40,0 20,5	 56 9 13 12	 69 87 78 62	 H=44,50 (P=0.000)**	0 x 2 (P=0.040)* 0 x 3(P=0.021)* 1 x 2 (P=0.000)** 1 x 3(P=0.000)** 2 x 3(P=0.000)**
Plaque 0 1 2 3	 58,46 49,82 42,87 35,89	 17,60 18,74 14,65 17,06	 62,0 53,0 42,5 29,0	 21 13 14 9	 78 87 81 77	 H=21,79 (P=0.000) **	0 x 2 (P=0.001)** 0 x 3(P=0.000)** 1 x 3(P=0.001)** 2 x 3(P=0.016)**
Fluorides 1 2 3	 53,71 38,44 14,33	 16,19 15,34 6,11	 56,0 40,0 13,0	 17 12 9	 87 79 21	 H=39,41 (P=0.000)**	1 x 2 (P=0.000)** 1 x 3(P=0.000)** 2 x 3(P=0.001)**
Saliva 0 1 2	 45,90 39,35 32,77	 17,03 20,23 12,48	 47,0 40,0 31,0	 13 9 12	 87 67 55	 H=7,53 (P=0.023)*	0 x 2 (P=0.009)**

When ICDAS was evaluated, the content, frequency, plaque (biofilm) and fluoride factors presented statistical difference around 1% with values of p = 0.000 for all factors and around 5% for the saliva factor with p = 0.049 (Table 3).

Table 3: Arithmetic means, standard deviations, medians, minimum and maximum values, non-parametric Kruskal-Wallis test and their significance and multiple comparisons of the study parametric parameters, according to the probability of avoiding carious lesions to the ICDAS percentage of the general sample.

Variables	Arithmetic mean	Standard deviation	Medium	Minimum	Maximum	Test - (P)	Multiple comparisons
Tooth decay 0 1 2	 42,12 41,96 37,86	 15,91 19,44 17,83	 41,0 42,0 39,50	 12 9 14	 78 81 63	 H=0,79 (P=0.67) n.s	 _____
Diet composition 0 1 2 3	 59,43 48,90 36,82 20,67	 10,85 14,68 15,60 0,58	 63,0 52,0 36,0 21.0	 45 22 9 20	 74 78 81 21	 H=31,34 (P=0.00)**	 0 x 2 (P=0.001)*:* 0 x 3(P=0.017)** 1 x 2 (P=0.000)** 1 x 3(P=0.000)** 2 x 3(P=0.048)*
Frequency 0 1 2 3	 62,50 52,83 39,49 23,39	 9,19 14,22 14,48 11,84	 62,5 54,0 38,0 20,5	 56 9 12 12	 69 81 78 62	 H=50,19 (P=0.000) **	 0 x 2 (P=0.022)* 0 x 3(P=0.021)* 1 x 2 (P=0.000)** 1 x 3(P=0.000)** 2 x 3(P=0.000)**
Plaque 0 1 2 3	 54,31 48,34 41,44 32,77	 15,96 17,32 14,81 14,18	 61,0 52,5 41,0 28,0	 21 12 14 9	 78 78 81 62	 H=24,96 (P=0.000) **	 0 x 2 (P=0.005)** 0 x 3(P=0.000)** 1 x 2 (P=0.047)* 1 x 3(P=0.000)** 2 x 3(P=0.004)**
Fluorides 1 2 3	 52,37 35,81 14,00	 15,14 13,55 6,24	 55,0 38,0 12,0	 17 12 9	 81 78 21	 H=47,04 (P=0.000) **	 1 x 2 (P=0.000)** 1 x 3(P=0.000)** 2 x 3(P=0.000)**
Saliva 0 1 2	 43,42 38,19 32,46	 15,80 20,20 12,78	 42,0 32,0 31,0	 12 9 12	 81 67 55	 H= 5,94 (P=0.049)*	 0 x 2 (P=0.022)

* Significance level of 5% ** Significance level of 1%

When the preventive measures were compared with the DMFT/dmft and ICDAS indexes none of the samples presented a statistically significant difference (Table 4).

Table 4: DMFT/dmft and ICDAS comparison, non-parametric Xa (chi-square) test and its significance in the samples.

Sample	P value
General	p= 0,767
Male	p= 0,87179
Female	p= 0,753
5 years	p= 0,924
12 years	p= 0,830
15 a 19 years old	p= 0,947
35 a 44 years old	p= 0,977

4 DISCUSSION

In this work the Cariogram used without salivary tests as a tool to interpret and map out a global risk of caries proved an accurate model, convenient to be used in clinical, low cost, teaching to the patient's motivation and easy interpretation, becoming thus an important ally in caries risk assessment, providing a more reliable diagnosis and treatment proposal, as corroborated by other authors.[7,8]

The Municipality of Arraial do Cabo had an average CPOD/ceo-d of 9.44, a similar data was reported in the National Survey of Oral Health SB Brazil 2010 in which the CPOD/ceo-d was 9.72.[9] When the sample was divided into age groups, at 5 years of age, a DMFT/ceo-d of 4.62 was observed; 12 years of 4.02 and from 15 to 19 years of 5.42, this data differs from the National Survey, where it was found for the respective age groups, CPOD/ceo-d of 1.14, 1,40 and 3,04 respectively. One of the factors attributed to these results, concerns the lack of fluoridation in public water supply in the municipality of Arraial do Cabo, which differentiated it from the Municipality of Rio de Janeiro, which has been fluoridated since its regulation in 1974.10 However, when the age groups of 35 to 44 years old and 65 to 74 years old were analyzed, the Municipality of Arraial do Cabo presented a CPOD of 14,25 and 20,18 respectively, lower data than SB Brasil 2010. These data can be explained by the fact that at the time, the municipality of rio de janeiro had not yet implemented water fluoridation.[10,11,12,13]

When the ICDAS index was used to assess past / present experience, considering the initial stages of the lesion as an already established disease, an average of 11.9 was obtained in the general sample. This value is increased, as shown above, in relation to the CPOD/ceo-d of the same region, as well as also presented by SB Brasil 2010 in the State of Rio de Janeiro, a fact that can be explained due to this index providing early recognition of the disease while the DMFT / ceo-d index considers an installed disease only a cavity lesion already cavitated.[14,15]

Evaluating the multifactorial aspects of caries disease raised by the Cariogram, the study showed that in the bacterial plaque factor (biofilm) score 2 (regular quality oral hygiene) was more prevalent, showing itself as a risk factor for the appearance of new caries lesions in this population. The relationship between dental biofilm and the development of carious lesions has also been corroborated in several studies that showed that plaque (biofilm) adhered to the tooth surface leads to changes in oral pH causing demineralization of dentinal structures.[16,17,18]

Salivary flow and buffer capacity of saliva, factors that associated with biofilm may show an increase in cariogenic potential, showed a normal factor (score 0), but in this population studied, the salivary flow factor was normal (score 0) in most of the population. sample similar to that reported by Peterson.[19]

The role of diet (content and frequency) as an etiological factor in the development of new carious lesions has been proven by several authors.[20,21] In the present study, in both factors diet content and diet frequency, score 2 (moderate diet content and maximum frequency of 7 meals per day) was more prevalent, showing a relatively high sugar and carbohydrate consumption, with high frequency in its ingestion, thus making a diet not very adequate from the nutritional point of view, this data corroborates with authors who show that a cariogenic diet increases the risk of developing new carious lesions.

The disease factor was not relevant as to the possibility of avoiding carious lesions in the smallest age groups, unlike the more advanced age groups (65 to 74 years), where there is a higher prevalence of chronic diseases, use of medications, etc., as shown by authors.[18,22,23]

Another data considered critical from the point of view of the risk of the appearance of new carious lesions is the fluoride factor. The higher frequency of score 2 (use of toothpaste only) associated with non-fluoridation in the supply of the water network in the Municipality of Arraial do Cabo, makes this factor a risk factor for the population studied. The action of fluorides as preventive measures against caries disease as well as their role in decreasing and controlling the disease of dental caries severity is unanimously discussed in the literature.[11,12,24]

For the clinical evaluation factor, score 1 was assigned in all cases in order to standardize the sample and allow other factors to express in a similar way the chance of avoiding new carious lesions.

Other studies[7,25] an adult age group showed a majority of patients at high risk of caries. When it was held the comparison between chance to avoid further injuries and the factors recommended by Cariogram, a significant difference was found in dietary factors (content and frequency), plaque (biofilm), fluorides and saliva.

This data was also analyzed in the study showing a positive correlation between the chance of avoiding new caries lesions with the caries experience, fluorides and lactobacilli counts and EGM.[26] A similar situation was described in the work of authors where the sector "susceptibility" (fluorides program, salivary secretion and saliva buffer capacity) showed greater impact on risk for caries followed by "diet" (content and

frequency), "bacterium" (plate count and EGM count) and "circumstances" (caries experience and related diseases).[14]

Petersson et al[7] held a job in order to elucidate whether the Cariogram could be used without the use of salivary tests to evaluate the risk of involvement of carious lesions and effective preventive proposals to avoid them. The study shows that "yes", the Cariogram has the ability to be used to assess the risk of tooth decay and identify risk patients, but their degree predictability of the results was significantly reduced.

The present study used the Cariogram without salivary tests, due to the high cost of such testing for public health preventing its use with a view to facilitating the identification of risk factors in the city of Arraial do Cabo evaluating the factors that they had greater and lesser impact on oral health conditions of the patient.

Another factor to be taken into consideration is that deleting a value in one of Cariogram boxes is not the same as assigning a value of "zero", because the program calculates a hypothetical value based on a remaining-based formula in the rest of the other variables. This study showed a great ability to plan an oral health program for a sample, based on the possibility to park the carious process, avoiding the occurrence of caries and social and financial cost of a restorer and mutilating or treatment.

5 CONCLUSIONS

The Cariogram is a valuable tool and can therefore be used to map out a global risk profile of chances to avoid the occurrence of carious lesions, from the risk of such losses, proposing from the local reality, a series of preventive measures if used correctly, try to avoid the occurrence of carious cavitations, generating lower cost to the public service as it reverses the dental practice of a healing action, restorative for health promotion, seeking to assist in the specific case, the population the city of Arraial do Cabo.

REFERENCES

1. Pitts N, Zero D. White Paper on Dental Caries Prevention and Management, A summary of the current evidence and the key issues in controlling this preventable disease. Caries Prevent Partnership, FDI-Colgate 2015.

2. FDI World Dental Federation (2016). Policy statement on dietary free sugars and dental caries. International Dental Journal, 66(1):9-10.

3. Taqi M, Razak IA, Ab-Murat N. Caries risk assessment in school children using reduced cariogram model. Pak J Med Sci. 2017;33(4):948-952.

4. Petersson GH, Åkerman S, Isberg PE, Ericson D. Comparison of risk assessment based on clinical judgement and Cariogram in addition to patient perceived treatment need. BMC Oral Health. 2017;17:13.

5. Ismael AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H, Pitts NB. The International Caries Detection and Assessment System (ICDAS): an integrated system for measuring dental caries. Community Dent Oral Epidemiol. 2007;35(3):170–178.

6. Bratthall D, Hänsel-Petersson G, Stjernswärd JR. 2001. Assessment of caries risk in the clinic - a modern approach. In: Advances in Operative Dentistry. Vol 2. Ed: Wilson NHF, Roulet JF, Fuzzi M. Quintessence Publishing Co, Inc. pp 61-72.

7. Peker I, Mangal T, Erten H, Alp G, Avci E, Akca G. Evaluation of caries risk in a young adult population using a computer-based risk assessment model (Cariogram). Journal of Dental Sciences. 2012;7(2):99-104.

8. Petersson GH, Fure S, Bratthall D. Evaluation of a computer-based caries risk assessment program in an elderly group of individuals. Acta Odontol Scand. 2003;61(3):164-71.

9. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. SB Brasil 2010: Pesquisa Nacional de Saúde Bucal: resultados principais / Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. – Brasília: Ministério da Saúde, 2012. 116 p.

10. Thylstrup A e Fejerskov O. Cariologia clínica, 2ª e., trad Sônia RL. Maike, São Paulo, Editora Santos, 1995. p. 283-310.

11. Dutra GV, Azevedo ID, Figueiredo MC. Cárie dentária: uma doença transmissível. Rev. bras. odontol 1997; 54(5):293-6.

12. Narvai PC. Cárie dentária e flúor: uma relação do século XX. Ciência & Saúde Coletiva2000, 5(2):381-392.

13. Birpou E, Agouropoulos A, Twetman S, Kavvadia K. Validation of different Cariogram settings and factor combinations in preschool children from areas with high caries risk. Int J Paediatr Dent. 2019 Jul;29(4):448-455.

14. Pitts NB, Ekstrand KR. International Caries Detection and Assessment System (ICDAS) and its International Caries Classification and Management System (ICCMS) - methods for staging of the caries process and enabling dentists to manage caries. Community Dent Oral Epidemiol. 2013;41(1):41-52.

15. Honkala E, Runnel R, Honkala S, Olak J, Vahlberg T, Saag M, Mäkinen KK. Measuring dental caries in the mixed dentition by ICDAS. Int J Dent. 2011. doi: 10.1155/2011/150424.

16. Addy M, Slayne MA, Wade WG. The formation and control of dental plaque - an overview. J Appl Bacteriol. 1992 Oct;73(4):269-78.

17. Almeida PF. Microbiota estreptocócica associada com a formação inicial da placa dental. Revista de Ciências Médicas e Biológicas 2002; 1: 33-41.

18. Newbrun, E. Cariology. 2nd ed. Baltimore: Williams & Wilkins,1983.

19. Petersson GH, Isberg P, Twetman S. Caries risk assessment in school children using a reduced Cariogram model without saliva tests. BMC Oral Health. 2010;10(1):5.

20. Gustafsson DE, Quensel CE, Lanke LS, Lundqvist C, Grahnen H, Bonow BE, Krasse B. The vipeholm dental caries studies: the effect of diferente levels of carbohydrate intake on caries activity in 436 individuals observed for five years (Sweden). Acta Odontol Scand. 1954;11(3-4):232-64.

21. Weiss RL, Trithart AH. Between meal eting habits and dental caries experience in preschool children. Am J Public Health Nations Health. 1960;50(8):1097–1104.

22. ABOPREV: Promoção de Saúde Bucal/Coordenação Léo Kriger. – 3ª ed. São Paulo: Artes Médicas, 2003.

23. Wennerholm K1, Emilson CG. Comparison of Saliva-Check Mutans and Saliva-Check IgA Mutans with the Cariogram for caries risk assessment. Eur J Oral Sci. 2013 Oct;121(5):389-93.

24. Nikiforuk G. Understanding Dental Caries- 1. Etiology and Mechanisms – Basic and Clinical Aspects. New York, Karger, 1985. P. 182-209.

25. Kavvadia K, Agouropoulos A, Gizani S. Papaginnouli L, Twetman S. Caries risk profiles in 2- to years-old Greek children using the cariogram. Eur J Dent. 2012;6(4): 415–421.

26. Hänsel Petersson G, Twetman S, Bratthall D. Evaluation of a computer program for caries risk assessment in schoolchildren. Caries Res. 2002;36(5):327-40.