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Gingival Health Related to Intake of Different Types of Foods and Body Mass Index in 12-year-old Schoolchildren

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Salud gingival y su relación con la ingesta de diferentes tipos de alimentos y el índice de masa corporal en escolares de 12 años

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ABSTRACT: Research on gingival health of 12-year-old schoolchildren in Costa Rica is scarce. Since nutrition is an integral component of oral health, this study aimed to determine gingival status of 12-year-olds at Carmen Lyra Public School, San José, Costa Rica, and correlate these variables with the frequency of intake of different types of food and body mass index (BMI (kg/m²)). Sixty-two 12-year-old schoolchildren were recruited. A periodontist assessed Plaque Index (Silness and Løe, 1964), presence of calculus, and Gingival Index (Løe and Silness, 1967). Gingivitis was defined as the presence of bleeding on probing (BOP) on at least one site, and the extent was classified according to the percentage of teeth whose gingiva presented BOP limited: 25-49% of teeth tested; extensive >50% of teeth tested. A semi-quantified food consumption frequency questionnaire was administered. BMI was calculated for each participant. Overall Plaque Index was 1.18. Calculus was present on 40.40% of the sample, 19.4% had supragingival calculus and 21% had either supragingival/subgingival calculus or both. Presence of calculus was related with number of bleeding surfaces ($p=0.030$). Number of teeth with calculus was related to bleeding ($p=0.029$), and number of bleeding surfaces ($p=0.009$). Gingival Index was 0.97, mild gingivitis. Gingivitis was present on 96.8% of children examined. Limited gingivitis was present in 11.5% of children and extensive gingivitis in 88.5%. None of the variables measured differed by gender. No relationships were found between the consumption of starchy foods, animal and vegetable protein sources, fruit, vegetables, fast foods, sugar sweetened beverages and desserts with Plaque Index, calculus, Gingival Index, and BOP. Teeth calculus was related with being overweight (chi-square=0.038). BMI for males was 20.21 and females 20.11. BMI was not related to BOP or calculus. Within the limitations of this pilot study, we concluded the prevalence

of gingivitis and calculus is high in the sample examined. A greater sample is needed to determine correlations between the frequency of foods evaluated and gingival health.

KEYWORDS: Gingival health; Nutrition; 12-year-old schoolchildren; Plaque Index; Gingival Index.

RESUMEN: La investigación sobre la salud gingival en escolares de 12 años en Costa Rica es escasa. Dado que la nutrición es un componente integral de la salud oral, este estudio tuvo como objetivo determinar el estado de salud gingival de los niños de 12 años de la escuela Carmen Lyra, San José, Costa Rica, y correlacionar estas variables con la frecuencia de ingesta de diferentes tipos de alimentos y el índice de masa corporal (IMC (kg/m²)). Sesenta y dos escolares de 12 años fueron reclutados. Una periodoncista calibrada, evaluó el índice de placa (Silness y Løe, 1964), la presencia de cálculo y el índice gingival (Løe y Silness, 1967). La gingivitis se definió como la presencia de sangrado al sondaje en al menos un sitio. La extensión se clasificó de acuerdo con el porcentaje de dientes que presentaba sangrado al sondaje. Entre un 25-49% de los dientes con sangrado al sondaje, gingivitis limitada y extensiva, si presentaba más del 50% de dientes con sangrado al sondaje. Se administró un cuestionario de frecuencia de consumo de alimentos. El IMC se calculó para cada participante. El índice de placa fue de 1,18. El cálculo estuvo presente en el 40.40% de la muestra, el 19.4% tenía cálculo supragingival y el 21% tenía cálculo supragingival / subgingival o ambos. La presencia de cálculo se relacionó con el número de superficies sangrantes ($p=0.030$). El número de dientes con cálculo, se relacionó con el sangrado ($p=0.029$) y el número de superficies sangrantes ($p=0.009$). El índice gingival fue de 0.97, gingivitis leve. La gingivitis estuvo presente en el 96,8% de los niños examinados. La gingivitis limitada estuvo presente en el 11.5% de los niños y la gingivitis extensa en el 88.5%. Ninguna de las variables evaluadas difirió por género. No se encontraron relaciones entre el consumo de harinas, fuentes de proteínas animales y vegetales, frutas, verduras, comidas rápidas, bebidas azucaradas y postres con el índice de placa, cálculo, índice gingival y sangrado al sondaje. El cálculo se relacionó con el sobrepeso ($\chi^2=0.038$). El IMC para los hombres fue 20.21 y las mujeres 20.11. El IMC no estaba relacionado con el sangrado al sondaje o cálculo. Dentro de las limitaciones de este estudio piloto, concluimos que la prevalencia de gingivitis y cálculo es alta en la muestra examinada. Se necesita una muestra mayor para determinar las correlaciones entre la ingesta de los diferentes tipos de alimentos evaluados y la salud gingival.

PALABRAS CLAVE: Salud gingival; Nutrición; Escolares de 12 años; Índice de placa; Índice gingival.

INTRODUCTION

Gingivitis is a mild form of periodontal disease and is a common oral health problem (1). Dental plaque is the etiological factor, therefore, gingivitis associated with bacterial plaque is the most common type of gingivitis (2). Gingivitis is a reversible disease, however, untreated gingivitis usually progresses to periodontitis, a more severe condition. For this reason, timely treatment of gingivitis prevents destruction of the periodontium.

The accumulation of dental calculus, is an important risk factor in the development of gingivitis and consequently periodontal disease. This deposit that forms on the surfaces of the teeth, provides a substrate for the retention of more dentobacterial plaque that promotes inflammation of the gingiva (3). Supragingival calculus does not always trigger the progression of periodontal disease (4), however, subgingival calculus in a host with a susceptible immune system, is a determining factor in the progression of periodontitis (5). Plaque-induced gingivitis promotes the formation of the periodontal pocket and increases the flow of minerals present in the crevicular fluid, that favors the formation of subgingival calculus (3,6). Several longitudinal clinical studies of both, initiation and progression of periodontitis in adolescents and young adults, have shown that calculus is a risk factor for initiation of periodontal disease (7) and is associated with the prevalence of this disease (8). The presence of calculus has also been associated with the development of gingival recessions (5). Other risk factors associated to gingivitis include bad oral hygiene (9), economic inequalities (10), and high sugar consumption (9).

The World Health Organization (WHO) has selected 5 and 12 years as the indicator age group for international benchmarking of children's oral health (11). Research on gingival health of these two age groups in Costa Rica is scarce. In a recent study by Murillo *et al.* (2018), the adult population

was studied in an age range between 18 and 50 years old, in Colombia, Costa Rica and Mexico (12). In this study, the prevalence of gingivitis in the three countries together was 96.6%, where moderate gingivitis predominated, in Costa Rica, 100% of the sample had some degree of gingivitis (12).

The global prevalence of gingivitis and calculus in 12-year-old children ranges from 23% to 100% (6, 13-17). The National Institute of Dental and Craniofacial Research of the United States, reported in a study that was conducted during 1986-87, that 60% of children 14 to 17 years-old had gingivitis, one third presented supragingival calculus and almost a fourth exhibited subgingival calculus (18). In a study in Puerto Rico in 12-year-old schoolchildren, gingivitis was found in 80.41% of 1586 children evaluated. Extensive gingivitis, defined as the percentage of teeth whose gingiva presented BOP on more than 50% of teeth tested, was present in 60.81% of all children. Schoolchildren attending public schools had a higher percentage of BOP than children from private schools. Calculus was detected in 61.59% of the sample, mainly supragingival calculus. Schoolchildren in rural areas had a significantly higher prevalence of subgingival calculus compared to schoolchildren in private schools (6).

Epidemiological studies show a higher prevalence of gingivitis in adolescents aged 12 and 13 years, compared with children between 5 and 11 years of age (19,20). This is favored by various factors, including an increase in the levels of steroid hormones and cellular receptors of these hormones in gingival tissue cells, which favors gingival inflammation during puberty (21).

The association between nutrition and periodontal disease is complex. The intake of micro or macronutrients from diet does not prevent or stop periodontal disease (22), but if these are lacking, they can be a risk factor that contributes to periodontal inflammation (23). For example,

there is evidence that micronutrient deficiencies can have an adverse impact on the health of the periodontium. In a randomized clinical trial, fruits, vegetables and berry juice was given in a healthy population in the experimental group, as supplementation to the diet, which showed positive effects on periodontal health with reduced BOP over a period of 2 months (24). Low Vitamin D and C consumption have also been related to gingival inflammation (25). Sugar and refined carbohydrates not only increase the risk of tooth decay, but have also been linked to bleeding gums. Several clinical trials have documented an increase of gingival bleeding when participants had a higher intake of sugars (26,27).

A meta-analysis carried out by the Department of Epidemiology of the School of Public Health at the University of Washington concluded that there is a relationship between nutritional status with tooth decay and gingivitis. They reported that a diet low in carbohydrates and high in protein and micronutrients, was capable of preventing dental caries and optimizing periodontal health (22). This is why it is necessary to assess the choice of food and beverages in children and adolescents, as well as the frequency of intake, in order to determine the effects of diet in oral health (28).

Obesity has been linked as a risk factor for inflammatory periodontal tissue destruction. Since adult and childhood obesity is one of the most serious public health problems worldwide, due to factors such as inadequate diet and decreased exercise, these aspects that are modifiable, should be prevented from a very early age. (29-32). The global prevalence in children of overweight and obesity increased by 10% between 1990 and 2010 (33).

According to the School of Nutrition of the University of Costa Rica, obesity represents in

Costa Rica, a major predisposing factor to chronic diseases, such as diabetes, cardiovascular disease and ischemic stroke (34), which represent the main causes of morbidity in the country and medical consultation at the Social Security System of Costa Rica (Caja Costarricense del Seguro Social) (35). The problem lies, according to experts, that in schools and in the community, there is access to unhealthy foods. For example, it has been found that foods consumed during school snacks, are products that are high in fat, sugar, sodium and deficient in essential nutrients. Also, a high consumption of sugary drinks is reported instead of water and a low or no intake of fruits and vegetables (35,36).

At the Carmen Lyra School located in Concepción of Alajuelita, San José, Costa Rica, children receive dental care by the Faculty of Dentistry of the University of Costa Rica throughout their school period. One of the goals of the Faculty of Dentistry is to seek educational strategies, so that this population implements in their daily life proper oral hygiene. Once they graduate from sixth grade, when they no longer have dental care in their educational center, they continue with good oral hygiene techniques.

This study aimed to determine gingival health and its relationship with the intake of different types of foods and body mass index in 12-year-old children attending Carmen Lyra School. The majority of 12-year-olds at Carmen Lyra School are sixth graders. This is the last year these children attend school and then continue their learning process in another school. It is important to study the oral status of this population since these children are in mixed dentition and puberty, which makes periodontal tissues to have an over-response to harmful agents such as, the dental biofilm and calculus (6).

METHODS

This cross-sectional study was approved by the Institutional Review Board of the University of Costa Rica.

Parents or guardians signed a written informed consent and children provided written assent approved by the Institutional Review Board of the University of Costa Rica.

The inclusion criteria were: 1) children of Carmen Lyra School with twelve years of age at time of recruitment and 2) healthy (no history of medical problems that contraindicate their participation in the study). The exclusion criteria were a child not competent to give their consent or unable to withstand a clinical procedure.

Each child was weighed and measured three times, without shoes or coats. After this, a semi-quantified questionnaire on the frequency of food consumption was administered, which evaluated both the frequency and quantities of foods consumed during the week (37). With this weekly reminder, the central components of the frequency questionnaire were evaluated, which were: 1) the quantities of the foods described in the list, by means of drawings of food portions and 2) the frequency of intake (37).

The clinical examination to determine gingival health was performed at the dental clinic of Carmen Lyra School. Gingival examination was performed by a calibrated periodontist (Dr. Karol Ramírez) with the patient seated in a dental chair, using the angle lamp of the chair as a source of illumination. Plaque index was assessed on the inner and outer surface of six index teeth using Silness and Løe (1964) (38) criteria (teeth 16, 11, 26, 46, 41 and 36). The original index was modified using the first molars of the four quadrants and not premolars, due to the age of the children evaluated. Gingivitis was defined as the

presence of BOP in at least one site. The extension was classified according to the percentage of teeth whose gingiva presented BOP. From 25 to 49% of the teeth tested, was classified as limited gingivitis, and extensive gingivitis if more than 50% of the teeth tested had BOP (6,39).

Subsequently, each child was given a toothbrush, toothpaste, and given oral hygiene instructions according to Stillman brushing and spinning technique (40). The participants practiced and brushed their teeth with water only.

Then, the child was evaluated to determine the presence of dental calculus, both supragingival and subgingival or both, in all teeth. Also, gingival health was determined using Silness and Løe Index, 1967 (41) using the periodontal probe of the World Health Organization (WHO) on teeth 16, 11, 26, 46, 41 and 36, in the six dental surfaces.

Statistical analysis was conducted using IBM SPSS STATISTICS version 22, to analyze variables on gingival health. Normality and homogeneity of the data was confirmed. Frequencies were obtained and crossing of variables were made, variance of means were calculated. Through a T-student test, the relationship between plaque index and gender was evaluated, as well as the presence of plaque and its relationship to children without excess weight, or not overweight (low weight and normal weight) and children with excess weight (overweight and obesity). These variables (gender and body mass index) were also related to the presence of BOP. The T-student test was used to analyze body mass index according to gender. An analysis of variance (ANOVA) was used to associate plaque index and presence of BOP with body mass index.

The chi-square test was used to relate the presence of dental calculus with gender and body mass index. Associations were made between the daily intake of several food groups (starchy foods,

animal proteins, vegetable protein, fruits, vegetables, fast foods, sugary drinks and desserts) with plaque index and with BOP through Pearson correlation.

RESULTS

Data was collected between June and July of 2019 and a total of 62 participants were recruited (31 boys and 31 girls).

PLAQUE INDEX

Average plaque index according to Silness and Loe, 1964 (38) was 1.18, indicating that the presence of dental plaque is not detectable with the naked eye, but observed when passing the probe over the dental surface. There were no statistically significant differences in the average of plaque index between boys and girls ($p=0.322$), but boys had a higher score, 1.24, than girls, 1.12.

Children that were not overweight had a higher plaque index score than overweight children 1.20 to 1.07, respectively, nonetheless, these results were not statistically significant ($p=0.421$) (Table 1). Pearson correlation showed a positive correlation between consumption of starchy foods, animal proteins and vegetable proteins with plaque index, however these results were not statistically significant either (Table 2).

DENTAL CALCULUS

The prevalence of calculus was 40.40%. Supragingival calculus was found in 19.4% of participants, and 21% participants had supragingival and subgingival calculus. No statistically significant differences were found ($p=0.160$) between the average number of teeth with calculus in boys, 1.30, compared to girls, 1.41. Overweight children had more teeth with calculus (1.60) than children without excess weight (1.30) ($p=0.038$) (Table 3).

Presence of calculus, number of teeth with calculus, and number of bleeding surfaces were significantly related to BOP ($p=0.030$), ($p=0.029$), ($p=0.0009$), respectively.

When comparing if the presence of calculus was associated with the daily average intake of different types of food, children with supragingival and subgingival calculus consumed an average of 1.39 starchy foods daily. Likewise, those who presented supragingival calculus only consumed an average of 1.48 starchy foods daily, this type of food was mainly related to the presence of calculus, however, this was not statistically significant ($p=0.348$) (Table 4).

GINGIVAL HEALTH

Gingivitis was identified in 96.8% of the schoolchildren. In terms of extent of gingivitis, 11.5% of participants had limited gingivitis and 88.5% extensive gingivitis.

On average, children evaluated had a gingival index of 0.97, according to criteria established by Silness and Loe, 1967 (41), meaning that mild gingivitis was predominant. According to this criteria, a score of 0.1-1.0 is classified as mild gingivitis, 1.1-2.0 as moderate gingivitis and 2.1-3.0 as severe gingivitis (30).

Using Pearson's correlation, it was observed that there was a positive correlation between the consumption of vegetable proteins, animal proteins, vegetables, and fast foods with increased BOP, however, these results were not statistically significant (Table 5).

In addition to the above, there was no statistically significant difference ($p=0.639$) between the average of teeth with gingival bleeding in boys which was 1 and girls, 0.94. When relating

number of teeth with BOP and body mass index, children without excess weight, had more teeth with gingival bleeding (0.97) than those in the overweight group (0.94).

NUTRITIONAL STATUS

Twenty seven children (43.5%) were classified as underweight, twenty five (40.3%) as normal weight, nine (14.5%) as overweight and one child (1.2%) as obese. No statistically significant differences were found among sexes.

An association was found between being overweight and the presence of dental calculus ($p=0.038$). However, according to the other variables analyzed, no statistically significant associations were found between the frequency of consumption of starchy foods, animal proteins, vegetable proteins, fruits, fast foods and desserts with plaque index, calculus or gingivitis. It was found that body mass index for boys was 20.21

and for girls 20.11, no statistically significant differences were found between gender.

The average daily frequency consumption of the different types of foods was analyzed and the most consumed were starchy foods, 1.76 per day, followed by animal proteins, 1.36 per day, sugary drinks, 1.15 per day, fruits, 1.07 per day, vegetables, 0.63 per day, fast food, 0.56 per day, vegetable protein, 0.53 per day, and desserts, 0.48 per day. Due to the already known focus on host inflammatory processes with regard to the etiology of periodontal disease, diet has become an important factor in host modulation. Investigations have shown that processed carbohydrates like sugar, white flour, and processed fatty acids like trans fats, and with low micronutrient density, promotes gingival and periodontal inflammation (42). Whereas, a plant-based diet, that includes complex carbohydrates (like in fruits, vegetables, legumes), Omega-3 fatty acids, micronutrients, phytochemicals, plant nitrates, and fibers, benefits oral and general health (42).

Table 1. Average dental plaque index by gender and BMI.

Classification	n	Average	SD	p
Boys	31	1.24	0.53	0.322 (T-student)
Girls	31	1.12	0.24	
Low weight	27	1.19	0.53	0.759 (Anova)
Normal Weight	25	1.23	0.46	
Overweight	9	1.11	0.38	
Obese	1	0.75	.	
Not overweight	52	1.20	0.50	0.421 (T-student)
Overweight	10	1.07	0.38	
Total	62	1.18	0.42	

n= number of participants, SD= standard deviation.

Table 2. Pearson Correlation of the frequency of intake of various types of food with plaque index.

Food Type	f	Pearson	Correlation
Starchy foods	0.584	0.0710	positive
Animal proteins	0.581	0.0714	positive
Vegetable proteins	0.491	0.0891	positive
Fruits	0.615	0.0651	negative
Vegetables	0.700	0.0499	negative
Fast foods	0.136	0.1917	negative
Sugary drinks	0.387	0.1118	negative
Desserts	0.210	0.1651	negative

f=frequency per day

Table 3. Dental calculus by gender and BMI.

Classification	n	Average	SD	chi cuadrado
Boys	31	1.30	0.42	0.160
Girls	31	1.41	0.29	
Low weight	27	1.48	2.53	0.367
Normal weight	25	1.12	1.94	
Overweight	9	1.77	2.60	
Obese	1	0.00	0.00	
Not overweight	52	1.30	2.25	0.038
Overweight	10	1.60	2.59	
Total	62	1.35	2.29	

n=number of participants, SD=standard deviation.

Table 4. Dental calculus and daily average intake of different types of food.

Food Type	Score 0 (n=37)		Score 1 (n=12)		Score 2 (n=13)		p
	average	SD	average	SD	average	SD	
Starchy foods	1.97	1.31	1.48	1.03	1.39	0.71	0.348
Animal proteins	1.51	1.21	1.21	0.68	1.06	0.55	0.344
Vegetable proteins	0.61	0.42	0.46	0.35	0.00	0.00	0.112
Fruits	1.16	1.05	1.04	1.63	0.84	0.63	0.651
Vegetables	0.61	0.64	0.51	0.74	0.78	0.78	0.616
Fast foods	0.63	0.46	0.45	0.41	0.00	0.00	0.301
Sugary drinks	1.22	0.71	1.07	0.81	1.02	0.81	0.662
Desserts	0.54	0.41	0.34	0.35	0.44	0.50	0.348

Score 0=without calculus, score 1=subgingival calculus, score 2=supragingival and subgingival calculus.

Table 5. Pearson Correlation between the frequency of intake of different types of food and BOP.

Food Type	p	Pearson	Correlation
Starchy foods	0.954	0.007	negative
Animal proteins	0.975	0.004	positive
Vegetable proteins	0.992	0.001	positive
Fruits	0.224	0.157	negative
Vegetables	0.946	0.009	positive
Fast foods	0.974	0.004	positive
Sugary drinks	0.179	0.173	negative
Desserts	0.521	0.083	negative

DISCUSSION

Average plaque index (Silness and Løe, 1964) was 1.18 and average gingival index was 0.97. There were no statistically significant differences in the average of both indexes between boys and girls. However, boys had a higher score of plaque index than girls. Accordingly, Qaderi and Taani in Jordan (43), and Weissenbach *et al.* (44) in France showed that boys had a higher plaque and gingival index compared with girls. However, there is a lack of agreement and discrepancies in literature, if boys have a higher plaque and gingival index than girls. For example, Mascarenhas in India (45) and Gopinath (46) report higher scores in girls than boys. This is partly explained since girls go into puberty earlier than boys. This lack of agreement in literature may be due to cultural differences, in which parents may pay more attention to their male or female children.

The prevalence of gingivitis in 12-year-old schoolchildren at Carmen Lyra School was 96.8%. This is similar to the prevalence of gingivitis reported by Murillo *et al.*, where the adult population of the Great Metropolitan Area in Costa Rica, Bogotá and Mexico City was evaluated. In this study the prevalence of gingivitis was 96.6%. This suggests that gingivitis is a common oral health problem regardless of age. One difference between the two studies is that in the adult population

examined, moderate gingivitis was predominant, while in this study, children presented mostly mild gingivitis (12), which precedes moderate gingivitis. Children who develop a mild form of gingivitis can be typically treated through professional dental cleanings and good oral hygiene routines.

Dental calculus was present in 40.40% of the participants, without statistically significant differences between boys and girls. This percentage is lower compared to other studies conducted in 12-year-old children from other countries such as Puerto Rico (61.59%), Ecuador (69.9%) and China (46%) (6,47,48). However, in an epidemiological study conducted by the Social Security System in Costa Rica (Caja Costarricense del Seguro Social), participants between the ages of 10 and 19, had only 8.23% of teeth with calculus (49). In our studied population, 19% had supragingival calculus and 21% had supragingival and subgingival calculus, the latter being a key factor in the development of periodontal disease. In addition, our data shows a positive relationship between the presence of calculus and BOP, this is due to the infectious burden of dental calculus that triggers inflammatory reactions in gingiva (50).

A statistically significant relationship was found, between being overweight and the presence of dental calculus, which is in accordance with a study conducted in adolescents in Mexico during

2014. In this study, a high percentage of body fat was associated with the presence of dental calculus (48). Also, a systematic review was conducted to associate the relationship between being overweight and periodontal health in children and adolescents. This study highlights the ability of obesity to stimulate inflammatory lineage cells (T lymphocytes, monocytes and macrophages) and their immune response to microbial agents. Additionally, it is mentioned that people with obesity tend to produce proinflammatory cytokines, adipokines and reactive oxygen species that can increase gingival inflammation (49). The results of this systematic review show a positive association between being overweight, obese, and the prevalence of periodontal disease. Multiple theories have been raised about biological interactions that influence the relationship between these variables, however, the specific molecular and cellular mechanisms responsible for this positive association are not clear (49).

In our study, twenty seven 12-year-old-schoolchildren had low weight, followed by 25 children with normal weight, 9 overweight and only one child with obesity. These data differ with that carried out in the first School Weight / Size Census carried out in Costa Rica in 2016, where a total of 347,379 children between the ages of 6 and 12 were evaluated and it was determined that 64% had normal weight, 20% overweight, 14% obese and only 2% underweight or malnutrition (50).

The food group reported to be consumed more frequently by the children evaluated in this study were starchy foods, which is expected, since the Costa Rican diet is characterized by a high consumption of carbohydrates. No statistically significant relationship was found between starchy food consumption and gingival health. However in other studies abroad, it has been determined that high carbohydrate consumption, favors the development of periodontal disease. For example, in Germany, it was determined that a low carb diet

can significantly reduce gingivitis (27). Also, an study was conducted, in which a group followed an a low carb diet. This study concluded that there was a significant relationship between diet and the state of gingival health, since following a low carb diet decreased gingival inflammation. However, they also showed that this type of diet had no influence on subgingival microbiota or inflammatory serological levels (27).

CONCLUSIONS

Few studies have been conducted and published in Costa Rica describing the epidemiology of gingivitis in 12-year-old schoolchildren. Even though it is a mild form of periodontal disease, high prevalence has been reported recently in adults worldwide. The prevalence of gingivitis reported, 96.6% in 12-year-old schoolchildren of Carmen Lyra School, is excessively high, despite the attention and oral education that has been provided since students start school. We recommend to reinforce the techniques of oral hygiene in this population. Also, dental calculus was present and related to gingival bleeding.

To our knowledge, in Costa Rica, a study on the relationship between the consumption of different food groups and oral health has never been conducted or published. In the present study, no statistically significant results were found between nutrition and oral health, on the studied variables, however studies with a larger sample are needed to assess an association between these two.

This is a pilot study to subsequently conduct a national study. Carrying out this study in a near future at a national level, will provide information, which can be disseminated in scientific journals and inform health authorities, in order to establish public health policies, that mitigate the prevalence of oral diseases in children. It is our goal as academic researchers to promote education in oral health.

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