

## CLINICAL RESEARCH

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Dental Caries in 12-Year-Old Schoolchildren who Participate in a Preventive and Restorative Dentistry Program

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Caries dental en escolares de 12 años que participan en un programa de odontología preventiva y rehabilitación oral

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**ABSTRACT:** Since 2013, the Faculty of Dentistry of the University of Costa Rica has provided a preventive and restorative oral health program at Carmen Lyra Public School. The first generation of students that received dental care from this project were examined in 2019 for caries status. A total of 62 twelve-year-old schoolchildren were examined (31 boys and 31 girls). First, all teeth surfaces were cleaned with a brush and then rinsed. Subsequently, examination was performed in each person by a calibrated examiner using the International Caries Detection and Assessment System (ICDAS). Prevalence of dental caries was 59.7%. ICDAS code 2 was the most prevalent (68.8%), followed by 1 (19.3%), 5 (4.5%), 3 (3.5%), 6 (2.5%), and 4 (1.4%). Regarding number of carious surfaces, the highest prevalence was observed in the occlusal surfaces (77.3%), followed by the vestibular (13.9%), mesial (4.2%), palatal/lingual (4,1%) and distal (0.5%). Of these carious surfaces, 7% were caries associated with restorations and were present only on the occlusal surfaces. Boys had more cavities than girls (54.1% compared to 45.9%), however, this difference was not significant. Regarding the condition of restorations in teeth, 92 dental restorations (resin or amalgam) were found in the population studied and were well adjusted. Most of these restorations were found on the occlusal surfaces (82.6%), followed by vestibular surfaces (8.7%), palatal/lingual (5.4%) surfaces, mesial surfaces (3.3%), and no restorations were detected on the distal surfaces. Sealants were identified in 11.3% schoolchildren; 98% were identified on the occlusal surfaces and the other 2% were found on the palatal/lingual surfaces. DMFT Index was  $1.6 \pm 0.71$ . The prevalence

of dental caries in this sample was low compared to other studies in twelve-year-old schoolchildren in Costa Rica. This may suggest that the oral health program had a positive impact in the studied population.

**KEYWORDS:** Oral health program; Caries 12-year-olds; Caries schoolchildren; Caries prevention.

**RESUMEN:** Desde el año 2013, la Facultad de Odontología de la Universidad de Costa Rica ha brindado un programa de prevención y rehabilitación oral en la Escuela Carmen Lyra. La primera generación de estudiantes que recibieron atención dental por parte de este programa, fueron examinados en el año 2019 para determinar la prevalencia de caries. Se examinó a 62 escolares de 12 años (31 niños y 31 niñas). Primero, todas las superficies de los dientes se limpiaron con un cepillo y luego se enjuagaron. Posteriormente, el examen fue realizado en cada participante por un examinador calibrado utilizando el Sistema Internacional de Detección y Evaluación de Caries (ICDAS). La prevalencia de caries dental fue del 59,7%. El código ICDAS 2 fue el más prevalente (68,8%), seguido de 1 (19,3%), 5 (4,5%), 3 (3,5%), 6 (2,5%) y 4 (1,4%). En cuanto al número de superficies cariadas, la mayor prevalencia se observó en las superficies oclusales (77,3%), seguidas de las vestibulares (13,9%), mesiales (4,2%), palatinas/linguales (4,1%) y distales (0,5%). De estas superficies cariadas, el 7% eran caries asociadas con restauraciones y estaban presentes solo en las superficies oclusales. Los niños tenían más caries que las niñas (54,1% en comparación con el 45,9%), sin embargo, esta diferencia no fue significativa. En cuanto al estado de las restauraciones dentales, se encontraron 92 restauraciones dentales (resina o amalgama) en la población estudiada y se encontraban bien ajustadas. La mayoría de estas restauraciones se encontraron en las superficies oclusales (82,6%), seguidas de las superficies vestibulares (8,7%), superficies palatinas/linguales (5,4%), superficies mesiales (3,3%) y no se detectaron restauraciones en las superficies distales. Se identificaron sellantes de fosas y fisuras en el 11,3% de los escolares. El 98% de estos sellantes se identificó en las superficies oclusales y el otro 2% se encontró en las superficies palatino/lingual. El índice CPOD fue de  $1,6 \pm 0,71$ . La prevalencia de caries dental en esta muestra fue baja en comparación con otros estudios en escolares de doce años en Costa Rica. Esto sugiere que el programa de salud bucal tuvo un impacto positivo en la población estudiada.

**PALABRAS CLAVE:** Programa de salud oral; Caries en niños de 12 años; Caries en escolares; Prevención de caries.

## INTRODUCTION

The Faculty of Dentistry of the University of Costa Rica (FDUCR) was founded in 1942 (1), and since then, it has played and integrative role in research, teaching and social action. Its vision aims to provide the Costa Rican population with approaches to improve oral health. The degree in dentistry requires completion of twelve school cycles, where courses are developed between four academic departments: Social Dentistry, Restorative Sciences, Diagnostic and Surgical Sciences, Pediatric Dentistry, and Orthodontics (2). On the last three semesters of dental training, students must attend a Pediatric Dentistry and Orthodontics Clinic at the FDUCR, where training in clinical procedures and interceptive orthodontics in children and adolescents is imparted.

In 2012, the Principal of the Carmen Lyra School requested guidance for the dental care of students to the dean of the FDUCR. It is to mention that Carmen Lyra School is a public school that includes pre-school and elementary. The school is located in Alajuelita, San José, Costa Rica, with an average of 800 to 900 students per year, with ages ranging from 3 to 14-year-old schoolchildren. It is in an area of high social risk with a low human development index (3).

The deanship at that time, back in 2012, had project named "Bring me back my smile", which aimed to contribute to strengthen values, health promotion, disease prevention and oral dental prevention and treatment in populations at social risk. The principal of the Carmen Lyra School and Dean of the FDUCR organized and carried out an activity called "A day to bring me back my smile". This one day activity was possible thanks to the collaboration of teachers, administrative staff and students. Oral health education (delivered through lectures and demonstrations by undergraduate dental students and faculty staff) and dental checkups were carried out in children aged 6 and

7. Unfortunately, as evidenced by dental examinations, a significant number of these schoolchildren presented decayed teeth.

All dental professionals know that dental caries becomes complex over time. If left untreated, it can affect children's quality of life. The definition of dental caries has varied in recent years, due the concept of an ecologic changes within the dental biofilm environment. It has been established that dental caries is promoted by a diet that includes frequent consumption of fermentable carbohydrates (mainly sugars) which leads to a shift in the population of microorganisms that are in symbiosis with a low carcinogenicity environment. In a high sugar carbohydrate diet, high carcinogenicity bacteria produce organic acids that promote the net loss of minerals from dental hard tissues and results in a carious lesion (4). Dental caries remains the most common chronic disease of children, and it is four times more common than asthma (5).

The need to reinforce oral health education and provide personalized oral health care at the Carmen Lyra School was a necessity. The decrease in dental caries in schoolchildren has been reported in literature to be a combination of factors including better living conditions, school-based weekly fluoride mouth rinse or varnish programs, better oral health behavior and the management of preventive oriented school health programs (6). Since schools are places that allow links between health and education, in 2013 a cooperative agreement between the FDUCR and Carmen Lyra School was signed to establish a school-based oral health program. The program was integrated into the curriculum of undergraduate dental students. Faculty authorities made the decision that undergraduate dental students would take the last semester of the Clinical Course of Pediatric Dentistry at the Carmen Lyra School. A dental clinic was set up on school grounds at the Carmen Lyra School, largely funded through the University of

Costa Rica. From 2013 to 2016, a group made up of 4 to 5 undergraduate dental students enrolled in the clinical course. These students were supervised by a pediatric dentist and orthodontist. Undergraduate dental students' duties included offering dental care to schoolchildren, individualized oral diagnosis through a medical and dental history, and preventive and curative dental treatments. A goal was to involve parents and school teachers in these educational strategies. During those years a total of 525 students at the Carmen Lyra School were attended.

From the year 2017 until now, dental treatments and oral health education for school children attending Carmen Lyra School, is carried out by 2 to 3 final year undergraduate degree studies students. The undergraduate students attend daily the school based dental clinic for two months, with the supervision of a pediatric dentist or an orthodontist. These undergraduate students are enrolled in the external clinical rotation course, as part of their dental curriculum education.

The purpose of this study was to assess the status of teeth in the first generation of schoolchildren that started the oral health program back in 2013. These schoolchildren concluded their sixth year (last year) of elementary school on 2019, and were examined for caries status using the decayed (D), filled (F), and missed (M) teeth due to caries (DMFT) Index and the International Caries Detection and Assessment System (ICDAS), a relatively new paradigm for the measurement of dental caries.

## MATERIALS AND METHODS

This cross-sectional study was approved by the Institutional Review Board of the University of Costa Rica (VI-5628-CEC-0007-2018).

Parents or guardians signed a written informed consent and children provided written assent.

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.

Clinical examination was performed by a calibrated examiner (Dr. Gómez-Fernández) at the dental clinic of Carmen Lyra School. Previous to the clinical examination, each child was given a toothbrush and given oral hygiene instructions according to Stillman brushing and spinning technique (7). Participants practiced and brushed their teeth with water only. If necessary, dental floss was used. For clinical examination, a flat mirror #4 without magnification was used and a triple syringe tip was used to dry teeth. Teeth were isolated with dental cotton rolls. A visual examination record sheet was used according to the guidelines described by the International Caries Detection and Assessment System (ICDAS-II), derived from the International Caries Classification and Management System ICCMS (8).

ICDAS is a system that was created to diagnose, classify and better understand tooth decay. The system is very useful in clinical practice, research and development of public health programs (9). ICDAS-II is a method that allows clinical and visual caries detection from earliest states to various stages of carious lesion progression. Assessment of both severity and level of activity of the caries lesions can be determined. It comprises 7 codes according to the caries lesion severity, being code 0 a healthy tooth and 6 an evident and extensive caries lesion that comprises of the exposure of dentin (8). Codes 00 to 02 indicate a favorable health state and a need for dental examinations. Codes 03 to 06 show a need for restorative treatments (10). Lesion activity assessment includes two additional codes (1 active, 1 inactive/2 active, 2 inactive) (11). A 0.5mm

diameter round-tipped OMS 11.5 probe was used to perform tactile inspection in case of doubt.

Statistical analysis was conducted using IBM SPSS STATISTICS version 22. The prevalence of dental caries was obtained making the sum of the schoolchildren who presented caries and then the sum of schoolchildren that did not present caries. To obtain the prevalence, a division was made between schoolchildren who had cavities and the total number of schoolchildren in the study.

In the same way, the database was used to obtain the results of the ICDAS II criteria, this base contained the data of Restoration and Surface Codes and Caries Codes C0 to C6. To obtain the index, the sum of the data was performed. The same was also done to determine the number of carious surfaces and the distribution of the lesions, as well as levels of caries, taking into account the same criteria.

Measures of central tendency (mean) for variables of number of cavities according to ICDAS-II criteria was calculated.

The DMFT score of the samples were determined based on the results of clinical examination and calculation of the number of decayed (D), filled (F), and missed (M) teeth due to caries. The mean number of DMFT was calculated by adding individual DMFT values divided by the sum of the population.

The Phi coefficient was used to compare prevalence of caries in female and male schoolchildren.

## RESULTS

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

A total of 202 decayed teeth were observed in the sample. Prevalence of dental caries was 59.7%. ICDAS code 2 was the most prevalent (68.8%), followed by 1 (19.3%), 5 (4.5%), 3 (3.5%), 6 (2.5%), and 4 (1.4%) (Table 1).

**Table 1.** Prevalence of dental caries codes.

Prevalence	Percentage
Code 1	19.3%
Code 2	68.8%
Code 3	3.5%
Code 4	1.4%
Code 5	4.5%
Code 6	2.5%
Total	100%

Regarding number of carious surfaces, the highest prevalence was observed in the occlusal surfaces (77.3%), followed by the vestibular (13.9%), mesial (4.2%), palatal/lingual (4.1%) and distal (0.5%). Of these carious surfaces, 7% were caries associated with restorations and were present only on the occlusal surfaces (Table 2).

**Table 2.** Prevalence of caries according to ICDAS II by dental surfaces.

Surface	Percentage
Distal	0.5%
Mesial	4.2%
Palatine/Lingual	4.1%
Buccal	13.9%
Oclusal	77,3%
Total	100%

Regarding the condition of restorations in teeth, 92 dental restorations (resin or amalgam) were found in the population studied and were well adjusted. Most of these restorations were found on the occlusal surfaces (82.6%), followed by vestibular surfaces (8.7%), palatal/lingual (5.4%) surfaces, mesial surfaces (3.3%), and no restora-

tions were detected on the distal surfaces (Table 3). Fourteen cavities were associated to restorations. All of them on the occlusal surface.

**Table 3.** Percentage of restorations by dental surface.

Surface	Percentage
Distal	0%
Mesial	3.3%
Palatine/Lingual	5.4%
Vestibular	8.7%
Occlusal	82.6%
Total	100%

Sealants were identified in 11.3% schoolchildren; 98% were identified on the occlusal surfaces and the other 2% were found on the palatal/lingual surfaces.

Boys had more cavities than girls (54.1% compared to 45.9%), however, this correlation was not significant ( $f = .25, p \geq .05$ ).

DMFT Index for all the sample was  $1.6 \pm 0.71$  (Table 4). According to the World Health Organization (WHO), this is considered a low quantification. The WHO DMFT index calculation criteria determines as very low quantification in the value of 0.0-1.1; low quantification in the value of 1.2-2.6; moderate quantification in the value of 2.7-4.4; and high quantification in the value of 4.5-6.5; and very high quantification in the value above 6.6 (12).

**Table 4.** DMFT Index.

Category	Mean $\pm$ SD
Decayed	$0.24 \pm 0.88$
Missing	$0 \pm 0$
Filled	$1.34 \pm 2.63$
DMFT	$1.58 \pm 0.71$

## DISCUSSION

School-based oral health promotion programs are considered a vital platform to reduce oral health diseases and prevent the development of new ones in areas with limited access to health resources (13,14). These programs are the result of a combination of strategies that bundle preventive services and interventional regimes. These strategies include and are not limited to: supervised toothbrushing and flossing exercises, fluoride application, nutritional education, examinations of teeth/screening, performing interventions in incipient carious lesions, and explaining to patients, parents, caregivers and school teachers the importance of changing habits (13,14,15,16). Additionally, school-based oral health programs provide a practical and effective intervention. A measurable outcome of success is a significant reduction in caries rates and improvement in indices such as the decayed, missing, and filled teeth (DMFT) scores (17).

Studies describing caries prevalence in Costa Rica, using the WHO criteria, reported a very high DMFT Index mean of 9.13 in 1984 in twelve-year-olds (18). In 1999 a lower DMFT Index mean of 2.46 was reported in this population (18). Back in 2006 the DMFT Index mean was still low, 2.57 (19). In our study, a very low DMFT Index was found, 1.6, which shows a reduction of the index. Even though our sample was low compared to the other studies, the school-based oral health program at Carmen Lyra School may have had a positive influence on oral health behaviors and disease prevention.

Studies on the prevalence of dental caries in Costa Rica using the ICDAS criteria are scarce as well. In Costa Rica the most prevalent code is 2 (initial stage caries) (20-22) meaning a distinct visual change in enamel when viewed wet (23).

Identifying dental caries from the initial clinical beginning is extremely important, because it gives the opportunity to carry out non-surgical caries management, as fluoride interventions (varnishes, gels, and toothpaste), sealants and resin infiltration and oral health education (23-24). All of the mentioned activities are feasible in school based-oral health programs.

In a Costa Rican study of 201 foster-care children and adolescents (20), between the ages of 2 and 17 years, dental caries prevalence was 96.35%. Another local study in 428 young male students aged 12 to 22, showed a prevalence of 83% (21). Moreover, the prevalence of caries was 41.3% in a study carried out in a small group of students at the Special Education Center "Fernando Centeno Güell" (22). It is noteworthy to mention that in the latter, the FDUCR has also a school-based oral health program, with a dental clinic on school grounds, in which final year undergraduate students rotate. This program also carries out clinical intervention and educational oral health strategies in schoolchildren attending this special education center. This study (22) demonstrated that school-based oral health promotion was an effective way to prevent and reduce caries incidence, improve oral hygiene and establish better oral health practices in the targeted school population, taking in consideration their special needs.

## CONCLUSIONS

The prevalence of dental caries in this sample was low compared to other studies in twelve-year-old schoolchildren in Costa Rica. Early caries lesions (ICDAS code 2) were the most common in the population studied. Performing motivation, education and careful monitoring could decrease the risk of dental caries progression. The activities that are carried out at Carmen Lyra dental clinic

may shape children's attitudes towards a better oral health lifestyle. As a matter of fact, oral health promotion at the school setting is recommended by the WHO.

Our results may suggest that the oral health program at the Carmen Lyra School, had a positive impact in the studied population. Early detection of dental caries may have had prevented the onset of the disease in the studied population. Recently, researchers found a decrease of more than 50% of untreated caries in a cohort of 6927 children enrolled in the Forsyth Kids preventive dentistry program, a school-based caries prevention program (27).

Oral health programs as the one implemented at Carmen Lyra School, that strives for: 1) reducing the prevalence of dental caries and other oral health-related problems, 2) reducing the severity of dental caries, and 3) improving schoolchildren's oral health through education involving parents and teachers, could be used at other public and private schools to care for the population. This could diminish the need for attention in the national care system and eliminate inequalities in oral health.

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