ORIGINAL ARTICLE

# Distribution of bilateral dental caries in first permanent molars of vulnerable Colombian schoolchildren: an epidemiological analysis

## Distribución de la caries dental bilateral en primeros molares permanentes de escolares colombianos en condición de vulnerabilidad: un análisis epidemiológico

*Camilo A. Romo-Pérez*[1], *Claudia Villafañe-Aguilar*[2]

[1] Director of the Research Center of Facultad de Odontología, Institución Universitaria Colegios de Colombia (UNICOC), Bogotá, Colombia. 0000-0001-9157-5093

[2] Full-time professor, Fundación Universitaria San Martín, Puerto Colombia, Colombia. 0009-0006-2471-1095

**ABSTRACT**

***Introduction:*** *the World Health Organization has established a global target to reduce the prevalence of oral diseases by 10 % by 2030. However, significant disparities persist between high- and low-income countries, in Latin American nations such as Colombia, Nicaragua, and Venezuela report some of the lowest standardized oral health care indices worldwide. In this context, strengthening primary health care and early detection strategies tailored to specific settings is essential to improve dental caries prevention. This study aimed to determine bilateral dental caries patterns in first permanent molars and their association with individual and socioeconomic factors among children attending a university dental clinic on Colombian Caribbean region.* ***Methods:*** *a cross-sectional observational study was applied to a census sample of children aged 5-12 years. Dental caries prevalence in maxillary and mandibular first permanent molars was assessed using ICDAS II criteria. Associations with socioeconomic, demographic, and clinical variables were analyzed. Bilateral dental caries was evaluated using the chi-square symmetry test and the Stuart-Maxwell test for marginal homogeneity.* ***Results:*** *caries in first permanent molars were present in 70.87 % of children, with higher bilateral prevalence in mandibular molars (61.17 %) than in maxillary molars (32.04 %). The distribution was symmetrical and homogeneous, particularly in the mandibular molars. Bilateral involvement was more frequent among children aged 7-9 years and those from households earning below the legal minimum wage.* ***Conclusions:*** *the findings suggest that caries showed an early bilateral pattern and was associated with socioeconomic disadvantage. Strengthening preventive strategies in socially vulnerable populations, particularly among children aged 7-9 years, is recommended.*

***Keywords:*** *dental caries, child, socioeconomic factors, cross-sectional studies, Colombia*

***Resumen***

***Introducción:*** *la Organización Mundial de la Salud ha establecido el objetivo global de reducir la prevalencia de enfermedades bucodentales en un 10 % para 2030. Sin embargo, persisten importantes disparidades entre países de altos y bajos ingresos, y países latinoamericanos como Colombia, Nicaragua y Venezuela presentan algunos de los índices estandarizados de atención de salud bucodental más bajos del mundo. En este contexto, es fundamental fortalecer la atención primaria de salud y las estrategias de detección temprana adaptadas a entornos específicos para mejorar la prevención de la caries dental. Este estudio tuvo como objetivo determinar los patrones de caries bilaterales en los primeros molares permanentes y su asociación con factores individuales y socioeconómicos en niños atendidos en una clínica odontológica universitaria de la región Caribe colombiana.* ***Métodos:*** *se realizó un estudio observacional transversal con una muestra censal de niños de 5 a 12 años. Se evaluó la prevalencia de caries en los primeros molares permanentes maxilares y mandibulares mediante los criterios ICDAS II. Se analizaron las asociaciones con variables socioeconómicas, demográficas y clínicas. La caries bilateral se evaluó mediante la prueba de simetría de chi-cuadrado y la prueba de Stuart-Maxwell para homogeneidad marginal.* ***Resultados:*** *se encontró caries en los primeros molares permanentes en el 70,87 % de los niños, con mayor prevalencia bilateral en los molares mandibulares (61,17 %) que en los maxilares (32,04 %). La distribución fue simétrica y homogénea, especialmente en los molares inferiores. La afectación bilateral fue más frecuente en niños de 7 a 9 años y en aquellos con ingresos inferiores al salario mínimo legal.* ***Conclusiones:*** *los hallazgos sugieren que la caries sigue un patrón bilateral temprano y se relaciona con desventajas socioeconómicas. Se recomienda fortalecer las estrategias preventivas en poblaciones socialmente vulnerables, especialmente en niños de 7 a 9 años.*

***Palabras clave:*** *caries dental, niño, factores socioeconómicos, estudios transversales, Colombia*

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# INTRODUCTION

Dental caries is a multifactorial disease resulting from oral microbial dysbiosis and complex interactions between the host, acidogenic microorganisms, fermentable carbohydrates, and individual predisposing factors. Key contribution to caries includes reduced salivary flow, insufficient fluoride exposure, poor self-care habits, socioeconomic disadvantages, and dietary conditions that promote a cariogenic environment. The persistence of these factors over time leads to mineral loss in dental tissues, initiating carious lesions that, if left uncontrolled, can progress significantly.[1,2]

The World Health Organization's Global Oral Health Action Plan aims to achieve a 10% global reduction in the prevalence of oral diseases by 2030. However, the epidemiological profile of dental caries varies significantly between high-income and low-income countries, a disparity largely driven by deep-rooted issues such as poverty and social inequality. According to Shoaee et al.,[3] several Latin American countries, including Nicaragua, Venezuela, and Colombia, rank among the lowest globally in age-standardized oral healthcare quality indices.

To address and prevent the widening of oral health disparities, it is crucial to strengthen primary care systems in low-income countries, emphasizing preventive measures. Early detection approaches such as a cornerstone of Primary Health Care (PHC) based system must be contextually adapted. In this regard, the DMFT (Decayed, Missing, and Filled Teeth) index is a widely used tool in dentistry that serves as a proxy for oral health by identifying teeth affected by caries. Nonetheless, studies conducted in Colombia suggest that the presence of bilateral dental caries in the first permanent molars (FPMs) may serve as a more sensitive early indicator of children's oral health, given these teeth's early eruption and structural vulnerability.[4]

FPMs, which typically erupt around age six, play a vital role in mastication and craniofacial development by guiding the eruption of adjacent teeth. Their high susceptibility to early dental caries makes them a potential biomarker for early oral health.[5,6] Despite their importance, the prevalence of bilateral dental caries in FPMs is alarmingly high, ranging between 80.8 % and 84 % in maxillary and mandibular molars, respectively.[7] Therefore, the condition of FPMs reflects not only biological factors but also social, behavioral, and environmental determinants, making them a valuable diagnostic tool for assessing general oral health and its links to health inequities.

Within this context, the presence of bilateral caries in FPMs emerges as a sensitive indicator of oral health disparities among Colombian children, particularly due to its association with socioeconomic vulnerability. Children from low-income households and those with caregivers with limited education show higher rates of caries in both primary and permanent molars.[8] Compared to their counterparts in better socioeconomic conditions, these children exhibited a 12.4 % higher prevalence of moderate to severe caries.

Although the DMFT index remains a useful reference for epidemiological surveillance by summarizing cumulative caries experience, it may underestimate emerging trends or specific bilateral patterns in younger populations.[6,9] In contrast, bilateral FPM dental caries may serve as a more sensitive early-risk indicator of poor oral health and social inequality, supporting the design of targeted preventive and educational interventions for vulnerable groups. Previous studies have shown that educational interventions aimed at improving parental knowledge and oral hygiene practices concerning FPMs function as protective factors for their retention.[10]

Thus, studying bilateral caries in FPMs not only provides a better understanding of children's oral health from an early perspective by revealing the epidemiological profile of caries in Colombian populations, but also contributes to reducing oral diseases through context-specific and equitable interventions.

Despite the high prevalence of dental caries in Colombia, a knowledge gap remains regarding the frequency and bilateral pattern of FPM involvement in the pediatric population of the Caribbean region. Currently, no recent data is available to determine whether these lesions follow a symmetrical distribution or how this pattern correlates with individual risk factors and socioeconomic determinants.

The present study aimed to determine the frequency of dental caries in FPMs among pediatric patients treated at a university dental clinic on Colombia's Caribbean coast. Additionally, the study analyzed bilateral patterns of carious lesions and their potential associations with individual risk factors and socioeconomic variables.

# METHODS

## Study Design and Participants

A cross-sectional observational study with a relational scope was conducted. The analyzed population consisted of 166 clinical records of children aged 5 to 12 years who received care between 2022 and 2023 at the Pediatric Clinic of the Dentistry Program at Fundación Universitaria San Martín, in Puerto Colombia, Atlántico, Colombia. A sample size calculation was used to estimate a proportion in a finite population, using as parameters a bilaterality proportion of 80 %, a certainty of 95 % and a statistical power of 5 %., resulting in an expected sample of 99 records. Case selection was performed using census sampling based on records that met all inclusion criteria, resulting in a final sample of 103 clinical records.

Records were included if they corresponded to patients with FPMs, and if their medical records were complete, unaltered, and signed by the supervising professor of Comprehensive Pediatric Clinics 1, 2, or 3. Exclusion criteria included patients undergoing orthopedic treatment with fixed appliances, as well as children diagnosed with Sjögren's syndrome or neoplasms undergoing radiotherapy.

## Measurements

The dependent variable was dental caries in FPMs, assessed using the International Caries Detection and Assessment System (ICDAS) II.[11] This index allows for the classification of dental caries across different stages of progression, from early enamel lesions to dentinal involvement. Its application requires the tooth surface to be completely dry to detect early-stage lesions, which can be challenging in underserved populations due to limited access to appropriate equipment. However, in this study, all participants were treated in a university dental clinic equipped with trained personnel and proper instrumentation, ensuring standardized procedures.

Independent variables were extracted from the clinical histories and included age, sex, and educational level of the child. Additional variables included daily sugar consumption (25 grams or more according to the food intake reported in the nutritional sheet), the presence of Developmental Enamel Defects (DED) (fluorosis is classified as absent, moderate, or severe by using the Dean's Index), dental alignment, and the O'Leary Plaque Index (categorized as good: 0–15 %, fair: 16–30 %, and poor: 31–100 %). Information was also collected regarding parental or caregiver occupation, educational level, and monthly household income (measured in minimum legal wages: SMLW = $1,623,500 COP or approximately 393 USD). Socioeconomic strata were also recorded, ranging from stratum 1 (lowest) to stratum 6 (highest).

### Statistical Analysis

The number of decayed FPMs had a normal distribution, which was assessed using the Shapiro-Francia test (SF = 0.561; p = 0.287). Consequently, quantitative variables were described using means and standard deviations, while qualitative variables were summarized as absolute and relative frequencies.

To evaluate the symmetry in the condition of FPMs (right vs. left) within each dental arch, the Stuart-Maxwell test of marginal homogeneity was applied. This non-parametric test is appropriate for paired nominal data in square contingency tables and was used to identify differences in caries severity between contralateral FPMs.

A significance level of $p < 0.05$ was set for all inferential bivariate analyses to reject the null hypothesis. Statistical analyses were performed using STATA 16 (StataCorp, College Station, TX, USA).

### Ethical Considerations

Written authorization was obtained from the audit office of Fundación Universitaria San Martín to access and extract data from clinical records, ensuring confidentiality in compliance with Colombian Law 1581 of 2012. Parents or guardians provided written informed consent prior to treatment. As this research was classified as minimal risk according to Resolution 008430 of 1993 from the Colombian Ministry of Health, the study was approved by the Research Coordination Office of Fundación Universitaria San Martín on May 25, 2024.

## RESULTS

The sample showed a higher concentration of participants aged 7 to 9 years (75.35 %), with a mean age of 7.57 ± 1.52 years and a slight predominance of males (55.34 %). Most children were enrolled in primary school (89.32 %) and came from low socioeconomic backgrounds, with 62.14 % belonging to socioeconomic stratum 1. Regarding household heads, 47.57 % had completed secondary education, and 43.69 % of mothers were unemployed. Additionally, 71.84 % of households reported earning less than one current legal monthly minimum wage, indicating a predominance of economic vulnerability and notable socioeconomic inequality within the study population (Table 1).

**Table 1.** Distribution of sociodemographic and economic characteristics of the sample.

| Variable | Category | n | % |
|---|---|---|---|
| **Age (years)** | **Mean = 7.57 / SD = 1.52** | | |
| | 5 | 1 | 1.37 |
| | 6 | 9 | 12.33 |
| | 7 | 17 | 23.29 |
| | 8 | 19 | 26.03 |
| | 9 | 19 | 26.03 |
| | 10 | 4 | 5.48 |
| | 11 | 4 | 5.48 |
| **Sex** | Female | 46 | 44.66 |
| | Male | 57 | 55.34 |
| **Educational level of the child** | Pre-kindergarten | 1 | 0.97 |
| | Kindergarten | 9 | 8.74 |
| | Primary education | 92 | 89.32 |
| | Secondary education | 1 | 0.97 |
| **Household socioeconomic stratum** | Stratum 1 | 64 | 62.14 |
| | Stratum 2 | 28 | 27.18 |
| | Stratum 3 | 11 | 10.68 |
| **Educational level of head of household** | None | 1 | 0.97 |
| | Not reported | 1 | 0.97 |
| | Primary | 11 | 10.68 |
| | Secondary | 49 | 47.57 |
| | Technical | 25 | 24.27 |
| | Undergraduate | 16 | 15.53 |
| **Father's occupation** | Unemployed | 2 | 1.94 |
| | Employed | 45 | 43.69 |
| | Self-employed | 46 | 44.66 |
| | Not reported | 10 | 9.71 |
| **Mother's occupation** | Unemployed | 45 | 43.69 |
| | Employed | 32 | 31.07 |
| | Self-employed | 25 | 24.27 |
| | Not reported | 1 | 0.97 |
| **Household income (Colombian Legal Monthly Minimum Wage (SMLV)in force)** | <1 SMLV (< USD 393) | 74 | 71.84 |
| | 1 SMLV (USD 393) | 24 | 23.30 |
| | >1 SMLB (> USD 393) | 5 | 4.85 |

**Source:** by the authors.

In 70.87 % (n = 73) of the children, at least one permanent first molar (PFM) was affected by dental caries, with over one-quarter of participants (n = 26) exhibiting caries in all four molars. Regarding

other clinical variables, 58.25 % of the children presented with dental crowding, and 63.11% had poor oral hygiene according to the O'Leary plaque index. Although 56.31 % reported brushing twice daily, 69.9 % consumed more than 25 grams of sugar per day (Table 2).

**Table 2.** Clinical and Behavioral Characteristics of the Sample.

| Variable | Category | n | % |
|---|---|---|---|
| Dental crowding | No | 43 | 41.75 |
| | Yes | 60 | 58.25 |
| Enamel developmental defects (DED) | Absent | 74 | 71.84 |
| | Moderate | 24 | 23.30 |
| | Severe | 5 | 4.85 |
| O'Leary Plaque Index | Good (0–15%) | 7 | 6.80 |
| | Fair (16–30%) | 31 | 30.10 |
| | Poor (31–100%) | 65 | 63.11 |
| Toothbrushing frequency | Once per day | 20 | 19.42 |
| | Twice per day | 58 | 56.31 |
| | Three times per day | 25 | 24.27 |
| Approximate daily sugar intake | < 25g | 31 | 30.10 |
| | > 25g | 72 | 69.90 |
| Presence of caries in first permanent molars (FPM) | Yes | 73 | 70.87 |
| | No | 30 | 29.13 |
| Number of carious FPM per patient | 0 | 30 | 29.13 |
| | 1 | 20 | 19.42 |
| | 2 | 13 | 12.62 |
| | 3 | 14 | 13.59 |
| | 4 | 26 | 25.24 |
| Bilateral maxillary caries | No | 70 | 67.96 |
| | Yes | 33 | 32.04 |
| Bilateral mandibular caries | No | 40 | 38.83 |
| | Yes | 63 | 61.17 |

**Source:** by the authors

In the maxillary molars, the proportion of sound surfaces (ICDAS 00) was uniform, with 58.25 % recorded for both teeth. However, tooth 26 showed a higher frequency of incipient lesions (ICDAS 02), reaching 28.16 %, compared to 20.39 % for tooth 16. Moderate (ICDAS 03) and advanced lesions (ICDAS 05–06) were infrequent in both teeth, each with values close to 6 %, suggesting limited disease progression in the maxillary region (Table 3).

**Table 3.** Distribution of the condition in the first permanent maxillary and mandibular molars.

| ICDAS Code | Upper Right FPM (Tooth 16) | | Upper Left FPM (Tooth 26) | | Lower Right FPM (Tooth 36) | | Lower Left FPM (Tooth 46) | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| ICDAS 00 | 60 | 58.25 | 60 | 58.25 | 51 | 49.51 | 49 | 47.57 |
| ICDAS 01 | 7 | 6.80 | 5 | 4.85 | 8 | 7.77 | 7 | 6.80 |
| ICDAS 02 | 21 | 20.39 | 29 | 28.16 | 15 | 14.56 | 20 | 19.42 |
| ICDAS 03 | 6 | 5.83 | 6 | 5.83 | 23 | 22.33 | 19 | 18.45 |
| ICDAS 04 | 3 | 2.91 | 0 | 0.00 | 1 | 0.97 | 2 | 1.94 |
| ICDAS 05 | 5 | 4.85 | 2 | 1.94 | 4 | 3.88 | 3 | 2.91 |
| ICDAS 06 | 1 | 0.97 | 1 | 0.97 | 1 | 0.97 | 3 | 2.91 |

**Source:** by the authors

In contrast, mandibular molars showed a lower proportion of sound surfaces, with 49.51 % in tooth 36 and 47.57 % in tooth 46, indicating greater caries involvement than in the maxillary molars. Moderate lesions (ICDAS 03) were more prevalent in the mandibular molars, with 22.33 % in tooth 36 and 18.45 % in tooth 46, suggesting more advanced diseases in this region (Table 3).

The findings revealed that bilateral caries in PFMs were more common in the mandibular teeth. In this sample, 61.17 % of children presented with bilateral caries in mandibular PFMs, compared to 32.04 % in maxillary PFMs.

An exploratory analysis was conducted to assess the relationship between socioeconomic, demographic, and clinical variables and bilateral caries in PFMs. Household income below one legal minimum wage was significantly associated with higher rates of bilateral caries in both maxillary ($Chi^2 = 105.597$; $p = 0.005$) and mandibular PFMs ($Chi^2 = 79.430$; $p = 0.019$). Although 44.66 % (n = 46) of the children had parents working in informal or independent occupations, this variable was not statistically associated with bilateral caries in PFMs ($Chi^2 = 65.346$; $p = 0.088$).

When assessing the condition of the maxillary PFMs, most surfaces were classified as ICDAS 00 (n = 50; 48.5 %), followed by ICDAS 02 (n = 12; 11.7 %). Symmetrical analysis between teeth 16 and 26 showed a predominance of concordance in the absence of lesions, with some variation in early-stage lesions. The symmetry test yielded a $Chi^2$ value of 10.89 ($p = 0.5382$), and the Stuart-Maxwell test indicated homogeneity ($Chi^2 = 7.58$; $p = 0.2707$), suggesting a symmetric and homogeneous pattern of caries distribution in the maxillary PFMs (Figure 1).

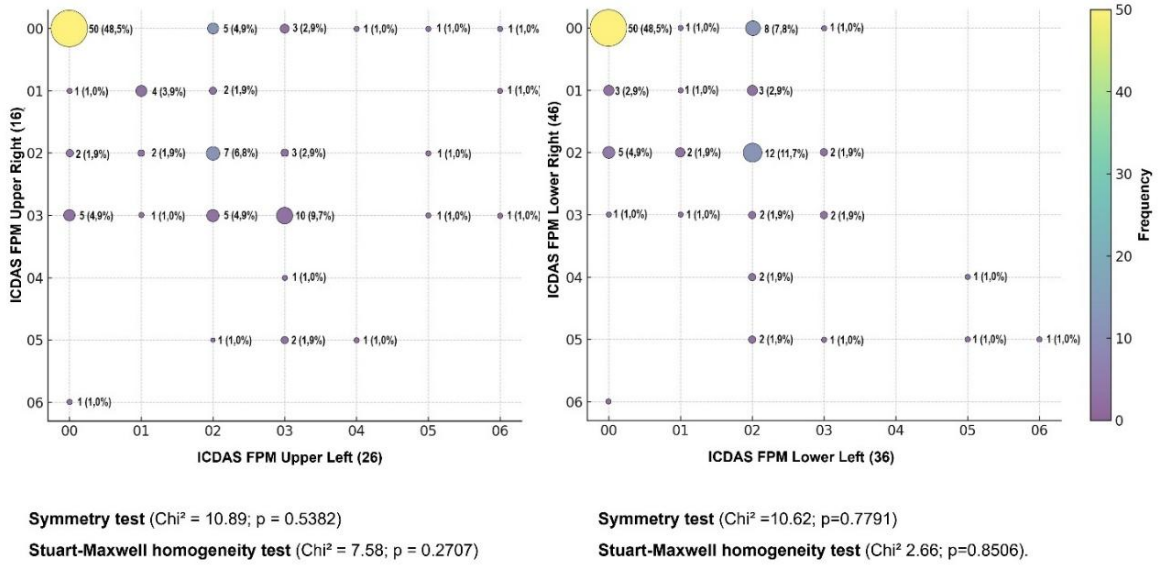


**Figure 1.** Bilaterality analysis of caries lesions in maxillary and mandibular PFMs.
**Source:** by the authors.

Similarly, in the mandibular arch, ICDAS 00 remained the most frequent code (n = 40; 38.8 %), although a greater proportion of more severe lesions was observed (ICDAS 03, n = 10; 9.71 %), followed by ICDAS 02 (n = 7; 6.8 %). More variation was noted in the comparative diagnoses. Nonetheless, a symmetric and homogeneous distribution of caries patterns was also observed in the mandibular PFMs, as indicated by the symmetry test (Chi² = 10.62; p = 0.7791) and the Stuart-Maxwell test (Chi² = 2.66; p = 0.8506) (Figure 1).

## DISCUSSION

This study analyzed PFMs in children aged 5 to 12 years, aiming to provide evidence of their utility as a proxy indicator of oral health. Their morphology and eruption pattern position them as key elements in preventive strategies due to their high susceptibility to biofilm accumulation and early-stage caries development.[12,13]

Furthermore, findings such as those by Jiménez-Gayosso et al.,[14] who demonstrated a strong positive correlation (Spearman's Rho = 0.9803; p < 0.0001) between the general DMFT index and the PFM-specific DMFT in Mexican schoolchildren, support the value of PFMs as critical markers in prevention strategies and in the design of interventions aimed at minimizing the progression of dental caries from an early age.

The present study identified caries involvement in at least one PFM in 70.87 % of the sample. These results are consistent with those reported by Kamiab N. et al.,[15] who observed a 68.6 % prevalence of caries in Iranian first-grade children, and by Gudipaneni RK et al.,[6] whose findings in Saudi children revealed a prevalence of 71.5 %. However, the data obtained differ from reports in Latin American

populations, where studies in Colombia indicate a prevalence of 11.4 %[4], in Mexico from 43.2 %[16] to 57 %[14], and in Romania 28 %.[17]

Regarding the involvement of all four PFMs, the present study found a frequency of 25.24 %, which is higher than those reported in other investigations. Meneses et al. [4], in Colombia documented that only 1.6 % of children had caries in all four PFMs, while Kamiab N. et al. [15] reported a prevalence of 17.9 % in Iranian schoolchildren. Similarly, Pontigo-Loyola AP et al.[16] reported a prevalence of 4.9 % in Mexican children.

This variability may be explained by differences in the origin of the analyzed samples, considering that studies with higher caries prevalence in PFMs were conducted in hospital settings, while those based on population samples observed lower prevalence. Differences in diagnostic criteria also contribute to this variation; this study employed the ICDAS system instead of the DMFT index, as the latter may underestimate the prevalence of early lesions, whereas ICDAS allows for more sensitive detection of white and brown enamel-confined lesions.[9]

Bilateral caries involvement in PFMs has been scarcely explored in scientific literature, despite its potential clinical and epidemiological relevance. The findings of this study align with previous research documenting symmetric patterns of caries involvement in PFMs. In this regard, Sadeghi M. et al.[7] reported bilateral involvement in 80.8 % of maxillary PFMs and 84 % of mandibular PFMs, while Jiménez-Gayosso et al.[14] recorded bilateral involvement of 84.1 % in maxillary PFMs and 81.3 % in mandibular PFMs. These data reinforce the hypothesis that the bilateral distribution of caries in PFMs responds to anatomical and functional factors that influence biofilm accumulation and disease progression.

The early age of caries involvement in PFMs is a highly relevant finding of this study, with a mean age of 7.57 ± 1.52 years, indicating that despite their short time in the oral cavity, these teeth already show significant compromise. Studies in Colombia, such as that by Meneses-Gómez E. et al.[4], have shown that the risk of occlusal caries peaks during the first year after PFM eruption and remains high in subsequent years for second permanent molars.[18]

In the present study, 28.15 % of the sample presented moderate to severe (DED). These mineralization abnormalities, characterized by areas of enamel loss or incomplete mineralization, have been widely recognized as predisposing factors for caries development, based on evidence from systematic reviews, due to their ability to facilitate biofilm retention.[19,20]

Early exposure to sucrose in children's diets has been identified as a key factor in the development of a cariogenic microbiota, facilitating colonization of newly erupted surfaces and increasing caries risk from an early age.[21] This phenomenon aligns with the present findings, which demonstrate high caries frequency in PFMs among children with a mean age of 7.57 ± 1.52 years, suggesting that dental vulnerability is established shortly after tooth eruption. Moreover, the high sugar consumption reported in Colombian populations (median = 56.6 grams/day of added sugar, with total consumption of 105.6 grams/day)[22] reinforces the hypothesis that the frequency and amount of sugar intake directly affect caries incidence and severity. This is particularly relevant considering that nearly 70 % of the children in this study consumed more than 25 grams of sugar per day.

Although more than 80 % of the children included in this study reported brushing their teeth two to three times a day, the frequency of caries in PFMs remained high. This finding is consistent with

previous evidence suggesting that a brushing frequency greater than twice a day does not significantly reduce caries risk, while, instead, the preventive effect is more strongly associated with the concentration of fluoride in toothpaste.[23,24] However, this study lacked sufficient data on exposure to fluoride toothpaste, which limits the ability to assess its impact on the sample.

Furthermore, studies such as that by Martignon et al.,[8] have noted that regular use of fluoride toothpaste and annual dental visits are insufficient to reduce disparities in oral health unless accompanied by improvements in education and structural conditions.

The findings of this study suggest a relationship between socioeconomic status and the presence of bilateral caries in the FFM, with children from households with incomes below the minimum wage and with parents who work informally or are self-employed exhibiting higher rates of bilateral caries. These results are consistent with previous findings indicating a significantly higher number of decayed teeth in children whose parents perform manual labor ($4.78 \pm 3.06$; $p < 0.001$),[15] reflecting the impact of socioeconomic inequality on children's oral health.

Although data collection took place in a university dental clinic under the supervision of pediatric dentists, it is important to note that the data were entered by student interns. The lack of inter-examiner calibration among these professionals constitutes a significant methodological limitation, as it may have generated variability in the application of diagnostic criteria. This lack of standardization could have influenced the consistency of clinical records. Therefore, future studies are recommended to implement systematic training and diagnostic calibration processes among examiners to strengthen data reliability.

To our knowledge, this is the first study to analyze the symmetry of caries incidence in low-income families within Colombian populations, contributing to our understanding of oral health disparities. Furthermore, the significant vulnerability of low-income families emphasizes the need for preventive strategies that facilitate early risk detection, promoting school-based and community-based interventions tailored to the population's social conditions. The correlation between the dental status of low-income family's dental status and overall caries rates confirms their importance as a key marker for risk assessment, underscoring the need to highlight the necessity for targeted interventions in socioeconomically vulnerable populations.

## CONCLUSIONS

The findings of this study confirm the high frequency of caries in FPMs, affecting 70.87 % of the sample. There is a more pronounced bilateral pattern in mandibular FPMs (61.17 %) compared to maxillary FPMs (32.04 %). Evaluation of caries distribution using symmetry and homogeneity tests suggests that the patterns of involvement in upper and lower FPMs are consistent and homogeneous, reinforcing the hypothesis of symmetrical disease progression in child populations.

Age emerged as a determining factor in bilateral FPMs involvement, with a significantly higher incidence in both maxillary and mandibular molars among children aged 7 to 9 years. Likewise, socioeconomic status surfaced as a key factor in the distribution of bilateral caries, demonstrating a higher frequency in children from households with incomes below one minimum wage, both in maxillary and mandibular FPMs.

## AUTHOR CONTRIBUTIONS

CARP: Project administration, conceptualization, data curation, formal analysis, investigation, methodology, resources, software, supervision, visualization.

CVA: Project administration, conceptualization, data curation, formal analysis, investigation, methodology, resources, software, supervision, visualization.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## CORRESPONDING AUTHOR

Camilo A. Romo-Pérez
camilo.romo.ow@gmail.com
Faculty of Dentistry
Colegios de Colombia University Institution
Bogotá, Colombia

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