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ORIGINAL RESEARCH

Prevalence of first permanent molar caries: an observational study in Ecuadorian pediatric population

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Abstract

Background: The present study investigates the prevalence of cavities in the first permanent molars in a sample of children aged 8 to 12 years in three provinces of Ecuador, focusing on the influence of geographical location (urban and rural areas) on cavity distribution. **Methods**: The International Caries Detection and Assessment System (ICDAS) was used for the clinical examination, allowing for the classification of carious lesions according to their severity. Additionally, the decayed, missing and filled teeth (DMFT) index was employed to determine cavity distribution. The sample size was calculated with a 99% confidence level and a 2.5% margin of error, ensuring representativeness of the target population. **Results**: A high prevalence of caries in the First Permanent Molar (FPM) (60.5%) was found, with a greater incidence in older children and those residing in rural areas. Lower molars were the most affected, and significant associations were observed between caries presence and age, province and rural/urban environment. The DMFT index was 1.02 (1.02 ± 0.8), with a higher presence of treated teeth in 10- and 11-year-old children and more extractions in the Morona Santiago province. Caries prevalence increased with age and was higher in rural areas. **Conclusions**: The high prevalence of caries in the FPM highlights a significant challenge in the oral health of Ecuadorian children, emphasising the importance of preventive interventions and targeted treatments to address this issue. The study also underscores the utility of the ICDAS system for a detailed evaluation of caries, although caution is advised due to the lack of data on the effectiveness of implemented interventions.

Keywords

Dental caries; Permanent molars; Pediatric population; Ecuador; ICDAS system

1. Introduction

The first permanent molars (FPM), typically erupting between the ages of 6 and 7 years, play a pivotal role in maintaining proper masticatory function and dental facial aesthetics [1–3]. It is essential to emphasise that the first permanent molars do not replace any teeth from the primary dentition; rather, they erupt after the second molars of the primary dentition. Although this process is well understood by dental professionals, the eruption sequence may lead parents to misinterpret it, viewing these molars as supplementary or replacement teeth. Such a misconception can increase their susceptibility to early caries, owing to insufficient attention to their care, which complicates proper oral hygiene and the effective removal of food debris [3–5].

The variability in the occurrence and seriousness of caries in the first permanent molars (FPM) has been extensively explored in numerous scientific investigations, revealing a broad spectrum of rates, ranging from 13.7% to 66.4% [4, 5]. This diversity highlights the intricate array of factors influencing dental health within the population and underscores the need for comprehensive approaches to caries prevention and treatment. In the realm of oral health, comprehending the prevalence and severity of dental caries in the first permanent molars (FPM) holds vital importance at both individual and community levels [5–7]. However, the accuracy of diagnosis can significantly fluctuate based on the methodology employed. While the Decayed, Missing and Filled Teeth (DMFT) index, established by the World Health Organization (WHO), has been widely utilized for assessing dental caries, it lacks the capacity to specifically inform clinical treatments based on lesion severity or individual patient risk [8, 9].

The evolution in dental caries assessment is reflected in the comparison between the DMFT index and the ICDAS system. While the DMFT, used for over five decades, focuses on counting teeth affected by decay, missing or restored, ICDAS proposes a more detailed and early evaluation of caries, allowing for less invasive interventions and a more precise classification of the disease's severity. ICDAS also promotes international standardization, improving study comparability. The combined use of both systems in this study ensures continuity with previous research and offers a more precise methodology for evaluating the effectiveness of preventive interventions [5–7].

In Ecuador, epidemiological studies are scarce, especially regarding the prevalence of caries in the first permanent molars, and even fewer focus on analyzing disparities between urban and rural areas of the country. The national study conducted in 2009 [10] provided a valuable overview, but since then, there has been a lack of updated and specific data on caries prevalence in these demographic groups. This lack of information hampers the accurate assessment of disease burden and the effectiveness of preventive intervention [11].

Living conditions and socioeconomic factors can significantly influence the oral health of Ecuadorian children, particularly in urban and rural settings. For instance, the availability and access to dental care services may vary considerably between these areas, which in turn can affect the prevalence and management of dental caries [11]. Children living in rural areas may face greater barriers to accessing preventive and treatment dental care, which may contribute to a higher prevalence of untreated caries.

Governmental initiatives aimed at addressing caries in the first permanent molars, such as sealing programmes and fluoridation campaign, share important steps towards improving the oral health of Ecuadorian children [12]. It's crucial that these interventions are tailored and expanded to address the specific needs of both urban and rural communities alike. This requires a more equitable approach in the distribution of oral health resources and services, as well as greater attention to oral health education and promotion in these communities.

The aim of our study is to ascertain the prevalence of dental caries in the first permanent molars among 8 to 12-year-old children in urban and rural settings across three provinces of Ecuador, taking into account variables such as age, gender, and geographic location. We will utilise the standardised criteria of the ICDAS for precise assessment.

2. Methods

2.1 Study design

This study was descriptive, observational and cross-sectional in nature, designed to assess the prevalence of caries in the first permanent molars (FPM) in a representative sample of children aged 8 to 12 years from three provinces in southern Ecuador: Azuay, Cañar and Morona Santiago. The study was approved by the University Council of the Catholic University of Cuenca (code 048 C.D-2019) and was conducted in accordance with the ethical principles of the Declaration of Helsinki. This study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines (STROBE).

2.2 Context

The research was conducted in three provinces in southern Ecuador (Azuay, Cañar, Morona Santiago) as part of a child public health study. Data collection took place between January and December 2021, including phases of recruitment, follow-up and data analysis.

2.3 Participants

A total of 1287 children aged 8 to 12 participated in the study. Of these, 618 were from urban areas and 669 from rural areas, distributed across the regions of Cañar, Azuay and Morona Santiago.

2.4 Variables

The sample size calculation was based on the expected prevalence of dental caries in the study population as the primary variable. The following variables were considered: gender, age, geographical area (urban/rural) and caries prevalence, measured by both the DMFT index and the ICDAS system.

2.4.1 Dependent variables

Prevalence of caries in the first permanent molar (FPM): Assessed with the International Caries Detection and Assessment System (ICDAS), which categorizes carious lesions based on severity. This variable quantifies the percentage of first permanent molars affected by caries in the sample.

DMFT Index (Decayed, Missing and Filled Teeth): Reflects the number of decayed, missing, and filled permanent teeth, providing an average score for the study population to assess the severity of dental caries.

2.4.2 Independent variables

Age: Categorized into age groups from 8 to 12 years, examining its correlation with caries prevalence and DMFT score.

Gender: Classifies participants as male or female to explore gender-based differences in caries prevalence and DMFT.

Geographical location (urban/rural): Compares the prevalence of caries and DMFT between children living in urban and rural settings.

2.5 Data sources/measures

Secondary data from the 2010 census were used to determine the total population. Caries prevalence was assessed through clinical examinations using the DMFT index and the ICDAS system, with trained evaluators ensuring standardization of the procedures.

2.6 Biases

To reduce biases, rigorous procedures were implemented for participant selection and clinical measurement standardization. Additionally, strategies were employed to ensure comparability between the different study groups.

2.7 Sample

The sample size calculation was performed using a formula to estimate proportions, with a confidence level of 99% ($\alpha = 0.01$) and a margin of error of 2.5%. A caries prevalence of 50% was assumed, which maximizes the required sample size and ensures sufficient statistical power to detect significant differences. The statistical power of the study was set at 99.9%, minimizing the risk of failing to detect a true difference and guaranteeing a high probability of identifying relevant associations between caries prevalence and associated factors, such as gender and geographic area.

The 2.5% margin of error was chosen to ensure that the estimates of caries prevalence do not significantly differ from the true population value, reflecting a rigorous methodological approach. Additionally, the sample size formula considered the variability in caries prevalence among subgroups of the population, such as age, gender and geographic location (urban/rural), ensuring that the sample size was adequate for stratified analyses and that the conclusions are representative and generalizable to the entire population of children aged 8 to 12 years in the provinces of the study [13–15].

2.7.1 Inclusion criteria for the study were as follows

Boys and girls aged between 8 and 12 years, according to information provided by school and census records.

Continuous residence in the provinces of Azuay, Cañar or Morona Santiago for at least one year prior to data collection, to ensure adequate geographical representation.

Informed consent signed by parents or legal guardians, as well as the voluntary acceptance of the children to participate in the study.

Regular attendance at public or private educational institutions in the selected urban and rural areas, without discrimination by type of institution.

2.7.2 As for the exclusion criteria, the following were considered

Children with a prior diagnosis of any chronic systemic disease or medical condition that could interfere with the study results (*e.g.*, genetic disorders, metabolic disorders or immunodeficiencies).

Students with a history of orthodontic treatment or those currently undergoing treatment, as it could influence the observed dental variables.

Children who were not permanent residents of the selected areas or who had changed residence within the last year.

Cases in which parents or guardians did not provide informed consent, or in which children did not voluntarily agree to participate in the study.

2.8 Calibration

The calibration process for the examiners was conducted to ensure uniformity in the application of ICDAS criteria for the detection of caries and restorations, as well as the DMFT index to measure caries prevalence in the evaluated population. The calibration included the following stages:

2.8.1 Theoretical training

The examiners were initially trained through theoretical sessions, during which the ICDAS and DMFT criteria were thoroughly reviewed. ICDAS, which is based on the visual assessment of carious lesions from initial to advanced stages, requires examiners to accurately identify the different stages of caries progression. The DMFT index was explained as a measure of the prevalence of decayed (D), missing (M) due to caries and filled teeth (F), used as an indicator of caries experience and treatment needs.

2.8.2 Practical training

After the theoretical training, practical exercises were conducted using dental models as well as simulated patients to familiarize examiners with the correct identification of caries according to the ICDAS system. This training was complemented by the evaluation of the DMFT index, ensuring that the examiners understood the accurate classification of decayed, missing and filled teeth in the oral cavity.

2.8.3 Intra- and inter-examiner agreement assessment

To ensure reproducibility and consistency in the application of the criteria, intra- and inter-examiner agreement indices were calculated. This was done using the kappa coefficient (κ), evaluating each examiner at two different times to measure intra-examiner agreement, and across different examiners for inter-examiner agreement. A κ value of ≥ 0.80 was considered acceptable to ensure high reliability in the detection and classification of caries.

2.8.4 Feedback sessions

During the calibration process, feedback sessions were organized where the examiners discussed discordant cases and resolved doubts to improve consistency in the identification of caries and restorations. This allowed for refining the use of ICDAS and the DMFT index, correcting potential biases and errors in the application of the criteria.

2.8.5 Periodic recalibration

Since the study was conducted over an extended period, periodic recalibrations were performed to ensure that the examiners maintained consistent application of the criteria throughout the study. This process contributed to the stability of the data collected and minimized inter-examiner variability.

International Caries Detection and Assessment System (ICDAS); classification system was utilized, wherein participating schoolchildren were assessed and grouped based on the condition of their FPM into the following categories: [16, 17].

Code 0: Used to describe healthy tooth surfaces with no visible evidence of caries, neither in the enamel nor in the dentin. This category included teeth that, even after prolonged drying, showed no signs of opacity or demineralization.

Codes 1 and 2: Employed to identify incipient caries. Code 1 was assigned to lesions visible only after drying, while code 2 was used for caries visible without the need for drying. Both indicated enamel demineralization without cavitation.

Codes 3 and 4: Classified moderate caries. Code 3 was assigned to localized cavities in the enamel without dentin exposure, while code 4 was used for lesions with an underlying shadow in the dentin, without visible cavitation.

Codes 5 and 6: Used for advanced or severe caries. Code 5 described cavities with exposed dentin, while code 6 was assigned to extensive cavities affecting a large portion of the tooth structure.

Six examiners participated in a calibration process that included theoretical and practical sessions, following the ICDAS criteria. Calibration was conducted with a pilot group of 15 children from each age group (8, 9, 10, 11 and 12 years).

The examiners evaluated the children on two occasions, with a one-week interval, to measure intra-examiner consistency and ensure diagnostic reliability. The inter- and intra-examiner kappa coefficient was 0.86, indicating excellent agreement in diagnoses [16, 18].

2.9 Examination

In order to carry out the evaluation of the children, it was essential for the participants to have a formal consent form signed by their legal guardian. Before the examination, pertinent demographic information such as environment, age and gender were gathered through the completion of a pre-examination form. Furthermore, participants in this study received comprehensive instruction on proper dental brushing technique from experienced dental students.

School-age children were examined on the school premises, in an area designated for the process, in an optimally lit environment with natural light and adequate ventilation, while seated in an upright position. Instruments utilized for assessment included a forward-facing white light, a periodontal probe meeting WHO specifications (Hu-Friedy) and a disposable dental mirror No. 5. All recommended biosafety guidelines by WHO were strictly adhered to. The intraoral clinical examination was conducted in a sequential and systematic manner, encompassing all first molars, commencing with tooth 16, followed by 26, 36 and lastly tooth 46. Throughout the diagnostic process led by the calibrated examiner, a senior student meticulously recorded the data on the odontogram, adhering to the criteria established by the ICDAS.

2.10 Statistical analysis

All the data were analysed using SPSS Statistics Version 25.0 (IBM, Chicago, IL, USA), employing the Chi-square test for categorical variables and the Mann-Whitney U test for mean comparisons. Correlations between age and DMFT were assessed using Spearman's rho correlation coefficient, while related means in the maxillaries were compared using the Wilcoxon test.protocol.

3. Results

In the study 1287 children participated in the study, with a balanced gender distribution (52.0% boys and 48.0% girls). Regarding age, 19.7% were 8 years old, 19.8% were 9 years old, 18.9% were 10 years old, 19.0% were 11 years old and 22.7% were 12 years old. The geographical distribution included 34.1% of children from the province of Azuay, 38.3% from Cañar and 27.6% from Morona Santiago. Regarding the area of residence, 48.6% of the participants lived in urban areas, while 51.4% resided in rural areas (Table 1).

3.1 Participant distribution and key caries indicators

The prevalence of caries reached 60.5%, with a proportion of 15.1% of filled teeth and a minimal 0.5% of missing teeth. The DMFT index recorded for the first molars was 1.02 (1.02 ± 0.8). Significant associations were observed between caries prevalence, participants' age, and institutional environment ($p < 0.05$). It was noted that children aged 11 years (60.7%) and 12 years (73.7%) exhibited a higher incidence of caries, while in rural environments, a percentage of 64.1% was observed. Concerning filled teeth, a significantly higher prevalence was observed in children aged 10 years (19.3%) and 11 years (19.7%) ($\chi^2 = 25.50$; $p < 0.001$). Additionally, a higher prevalence of missing teeth was evident in the Morona Santiago province ($\chi^2 = 7.480$; $p < 0.024$). The DMFT index showed a slight correlation with age, with an increase from 0.83 to 1.29 in children aged 8 to 12 years ($rs = 0.190$; $p < 0.001$). Similarly, a significantly higher DMFT index was observed in rural areas (DMFT = 1.05; 1.02 ± 0.8).

3.2 Caries indicators by tooth

Able 2 provides a breakdown of children's distribution according to the categories established by the ICDAS and their corresponding DMFT index. It was observed that tooth 46 had the highest prevalence of caries (31.2%), closely followed by tooth 26 (28.4%). Conversely, caries prevalence was found to be below 21% in teeth 36 and 16. Moreover, tooth 36 had the highest proportion of fillings, and teeth 36 and 46 were most frequently extracted due to caries (Table 2).

3.3 Dental arch-specific caries indicators (upper jaw, lower jaw)

The caries indicators, segregated by jaw (upper jaw, lower jaw), revealed that in the upper jaw, a caries prevalence of 37.8% and an 8.2% prevalence of filled teeth were recorded. Conversely, in the lower jaw, a notably higher prevalence of caries was observed, reaching 46.6% ($p < 0.01$). Additionally, it was noted that all teeth lost due to caries belonged to the lower jaw, while the prevalence of filled teeth was similar in both jaws. The DMFT index exhibited a significant increase in the lower jaw; median (M) = 0.56; Standard deviation (SD) = 0.54 (Table 3).

4. Discussion

This study highlights the crucial importance of the first permanent molars (FPM) in craniofacial development and oral health, not only for their role in establishing occlusion but also for their influence on the alignment of subsequent permanent teeth [15]. However, as the first permanent posterior teeth to erupt, their clinical relevance is often underestimated, which can delay necessary preventive interventions [17]. The eruption of the FPM coincides with the presence of deciduous dentition, potentially masking oral health problems during this critical stage [5]. Additionally, research has emphasized that proper protection of the FPM during its eruption is essential for preventing future dental diseases, as these teeth, by establishing the foundational occlusal axis, influence the long-term stability of the dental arch [16].

By using both the ICDAS system and the DMFT index, our study provides a precise overview of the prevalence of caries in this population, employing a methodological approach that allows comparison with previous studies while offering valuable insights into the effectiveness of preventive interventions. The

TABLE 1. Participants and main caries indicators.

	n	%	Decayed %	Filled %	Lost %	DMFT (SD) U/p
Sex						
Man	669	52.0	60.4	16.3	0.3	1.03 (0.84)
Woman	618	48.0	60.7	13.8	0.8	1.01 (0.85)
χ^2 (p)			0.11 (0.915)	1.618 (0.203)	1.545 (0.214)	2035.5/0.575
Age						
8 years	253	19.7	54.2	7.1	0.0	0.83 (0.83)
9 years	255	19.8	54.9	11.0	0.4	0.85 (0.81)
10 years	243	18.9	57.6	19.3	1.2	0.99 (0.80)
11 years	244	19.0	60.7	19.7	1.2	1.10 (0.84)
12 years	292	22.7	73.3	18.2	0.0	1.29 (0.83)
χ^2 (p)			28.45 (<0.001)	25.50 (<0.001)	7.352 (0.118)	47.3/<0.001
Age						
Azuay	439	34.1	59.9	15.9	0.0	1.03 (0.85)
Cañar	493	38.3	60.4	15.8	0.4	0.98 (0.84)
Morona Santiago	355	27.6	61.4	13.0	1.4	1.06 (0.83)
χ^2 (p)			0.187 (0.911)	1.171 (0.424)	7.480 (0.024)	0.05/0.976
Environment						
Urban	626	48.6	56.7	15.2	0.2	0.99 (0.85)
Rural	661	51.4	64.1	15.0	0.9	1.05 (0.83)
χ^2 (p)			7.441 (0.006)	0.010 (0.921)	3.325 (0.068)	1928.5/0.014
Total	1287	100	60.5	15.1	0.5	1.02 (0.84)

Note: n: number; DMFT: rate of Caries, Missing and filled Chi Square; p: Statistical; SD: standard deviation. $p < 0.05$ (significant relationship); χ^2: Chi-squared.

TABLE 2. Caries indicators according to the affected molar.

Code ICDAS	Code DMFT	P16Max		P26Max		P36Max		P46Max	
		ICDAS (%)	DMFT (%)	ICDAS (%)	DMFT (%)	ICDAS (%)	DMFT (%)	ICDAS (%)	DMFT (%)
0		67.4		60.5		70.5		53.5	
1	0. Healthy	0.4	77.5	0.4	67.1	0.0	73.3	0.6	64.2
2		9.8		6.2		2.8		10.1	
3		8.6		15.3		2.8		24.2	
4		2.4		7.8		7.7		2.7	
5	1. Decayed	4.1	17.6	2.6	28.4	5.9	20.7	1.4	31.2
6		2.5		2.6		4.4		2.8	
7 RP	2. Restored	0.0	4.8	0.1	4.5	0.0	5.7	0.7	4.3
8 RT		4.8		4.4		5.7		3.6	
9 DE	3. Lost		-		-	0.3	0.3	0.4	0.4

Note: ICDAS: international Caries Detection and Assessment System; DMFT: decayed, missing, and filled teeth; RP: Restored lost or fractured; RT: Temporary restoration (Glass ionomer, irm); DE: Tooth extracted due to caries; Max: Refers to the maximum value obtained for the ICDAS (International Caries Detection and Assessment System) and DMFT (Decayed, Missing and Filled Teeth) indices in each group of teeth.

TABLE 3. Caries indicators by jaw (Upper jaw/Lower jaw).

	Decayed		Filled		Missing		DMFT (SD)
	n	%	n	%	n	%	
Upper jaw	487	37.8	106	8.2	0	0.0	0.46 (0.53)
Lower jaw	600	46.6	110	8.5	7	0.5	0.56 (0.54)
p	<0.001		0.819		-		$Z = -5.091, p < 0.001$

n: Sample size; SD: standard deviation; DMFT: decayed, missing, and filled teeth; Z: Standard scoring. $p < 0.05$ (significant relationship).

dual advantage of using both tools lies in their capacity to offer comparative data with previous research based on the DMFT index, while also providing a more detailed evaluation of the clinical status of caries from their earliest stages—something essential for assessing the effectiveness of the implemented preventive measures.

The 60.5% prevalence of caries in the FPM observed in this study is consistent with previous research using the ICDAS system for caries detection, such as the studies by Wu *et al*. [18] (2020) and Gudipaneni *et al*. [9] (2022), which reported caries prevalence rates of 58% and 64%, respectively. These findings highlight the significant burden of caries in children aged 8 to 12 years and the utility of the ICDAS system for a detailed assessment of this condition. However, the differences in caries prevalence observed in studies such as Arrow (2008), which reported a 25% prevalence in Australia, suggest that access to preventive interventions, such as water fluoridation and fissure sealant programs, may account for part of the disparity between regions [8]. This contrast underscores the need to strengthen public health policies in Ecuador, where caries rates remain high, as reflected in the national oral health study conducted by the Ministry of Public Health (2009), which documented a caries prevalence between 85% and 90% in both urban and rural areas [10].

The observation that tooth 46 was the most affected by caries, while tooth 36 presented the highest number of restorations, aligns with the literature suggesting that the first mandibular molars, due to their earlier eruption, are more susceptible to early-stage caries development [19]. Although fissure sealants are widely used as a preventive measure, their effectiveness depends on proper application and follow-up, which often proves challenging, especially in resource-limited settings [20]. In this regard, our findings suggest that complementary measures, such as periodic fluoride application and improved oral hygiene instruction, should be considered to provide more effective protection for the FPM. Furthermore, the inclusion of probiotics in preventive dental treatments for children, as recent studies suggest, is recommended [21]. Probiotics have been shown to reduce cariogenic microorganisms, providing an additional defense against caries development, contributing to better protection of the FPM. Similarly, the use of fissure sealants remains a highly effective strategy to prevent the progression of caries in susceptible teeth [22], and both approaches should be robustly integrated into public health programs aimed at vulnerable pediatric populations.

The study also revealed a clear relationship between caries prevalence and the age of the children, with caries severity increasing as the children grew older, consistent with previous epidemiological research in Ecuador and other countries [23, 24]. This pattern highlights the need for more precise and effective preventive protocols. Despite existing efforts, such as the use of fluoride and sealants, our results indicate that current preventive measures are insufficient to adequately address the high prevalence of caries in the first permanent molars, particularly in rural and low-income communities [25]. The impact of contextual factors, such as limited access to preventive programs in Ecuador, underscores the need for greater investment in public health policies that promote water fluoridation and access to advanced preventive interventions, such as fissure sealants, which have proven effective in significantly reducing caries prevalence in other countries [8].

However, this study presents certain limitations that should be considered. The sample focused on schoolchildren from a specific region of Ecuador, which may limit the generalizability of the findings to other areas or age groups. Additionally, as a cross-sectional study, it does not allow for observation of the progression of caries over time, nor does it evaluate the long-term effectiveness of the recommended preventive interventions, such as the use of probiotics or fissure sealants [21, 22]. Other factors, such as socioeconomic status, diet or access to dental care, which may influence caries prevalence, were not considered. Moreover, while the use of probiotics and fissure sealants was suggested as preventive interventions, the study did not directly incorporate these strategies into the population studied, limiting conclusions about their effectiveness in this specific context [26–28]. Finally, the research focused solely on the FPM, without considering the condition of other permanent or temporary teeth, which could have provided a more comprehensive view of the children's oral health.

Our findings reinforce the need to implement more effective and accessible preventive strategies that include both continuous oral hygiene education and access to preventive treatments. The high prevalence of caries in the FPM underscores deficiencies in current public health policies, highlighting the urgency for greater investment in sustainable preventive programs. These programs should focus on prevention from the early stages of dental eruption, using precise diagnostic tools such as ICDAS and ensuring access to high-quality preventive interventions. The findings of this study provide a solid foundation for developing more inclusive policies that improve long-term oral health outcomes in vulnerable populations.

5. Conclusions

The study revealed a high prevalence of dental caries in children aged 8 to 12, with notable differences by region and age. Tooth 46 was the most affected, followed by tooth 26, while teeth 36 and 16 showed a lower incidence of caries. Additionally, a higher prevalence of caries was observed in the lower maxilla compared to the upper maxilla, with all teeth extracted due to caries located in the lower maxilla, indicating greater vulnerability in this area.

The DMFT index was higher in the lower maxilla and increased with age, with 11- and 12-year-old children being the most affected. A higher proportion of filled teeth was observed in younger children. These results reflect a growing trend of caries as age increases, particularly in the first molars, which suggests a significant disease burden in these key teeth.

Environmental and institutional factors also played a role, with rural children experiencing a higher prevalence of caries and a greater DMFT index compared to urban children. This finding underscores the importance of addressing geographic disparities in oral health, with a particular focus on rural areas.

In conclusion, these results emphasize the need for more effective preventive and treatment strategies, targeting older children and rural populations, to reduce the incidence of caries and improve oral health outcomes in this age group.

AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are included in this published article.

AUTHOR CONTRIBUTIONS

MM and AA—Study conception and design. EVL, MACL, PPN, SV—data acquisition. EVL, MACL—data analysis and/or interpretation. EVL, MACL, PPN, SV—drafting of the manuscript. MM, SV and EVL—critical revision of the manuscript for important intellectual content. MM and AA—approval of the manuscript version for publication. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study has been approved and authorised by the governing board of the Academic Unit of Health and Wellbeing at the Catholic University of Cuenca, in accordance with the Declaration of Helsinki, as per Resolution No. 048 C.D-2019, in the ordinary session held on 14 February 2019. Written informed consent was obtained from the parents or legal guardians of the patients.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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