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Research Article

Incidence Rate of Dental Caries in First Molar Teeth Among Students at Sombonnongbouathong Primary School, Vientiane, Lao PDR

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Abstract

The first permanent molar (FPM) are the inaugural element of the permanent dentition to emerge, typically erupting at approximately six years of age without the exfoliation of a precursor deciduous tooth. Often referred to as the "6-year molar," it serves as the cornerstone of the dental arch, playing a primary role in masticatory efficiency and the stabilization of the vertical dimension of the occlusion. Beyond its functional role in comminution (grinding food), the FPM is essential for the structural integrity of the developing dentition. It acts as a guide for the eruption of subsequent permanent teeth and is the primary determinant of the molar relationship and overall occlusal bite.

Objective: The primary objective of this investigation is to evaluate the prevalence and clinical distribution of dental caries specifically within the first permanent molars (FPM) among the pediatric student population, spanning Grades 1 through 5, at Sombonnongbouathong. Than Primary School in Vientiane, Lao PDR.

Methodology: This investigation employed a cross-sectional, descriptive research design to evaluate the oral health status of the target population at a specific point in time. The study utilized a quantitative approach for data collection, Statistical Analysis The collected data were processed and analyzed using SPSS Statistics (Version 20). Descriptive statistics were utilized to calculate prevalence rates and distribution patterns, with the final results synthesized and presented through standardized analytical tables.

Results: A total of 173 participants, including 72 females (41.6%) and 101 males (58.4%), had a prevalence of dental caries (74.5%) and non-carious teeth (25.5%). The most common age group was 10 years old with dental caries (29.5%). The number of dental caries of the first molars was 295 (43.0%), while the number of non-carious teeth was 397 (57.0%). The number of teeth with 5 teeth is equal to (0.72%). The highest rate of caries is N: 46 and N: 36 with the same number of caries (52.0%), followed by N: 26 with the total number of caries (31.7%) and the least common is N: 26 with the total number of caries (31.7%). The most carious surface of the teeth is the anterior surface (226 surfaces).

Conclusion: This study found that the prevalence of dental caries in the first molars was high, especially in molars N: 46 and N: 36, which mostly occurred on the anterior surface.

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1. Introduction

The first permanent molar (FPM) is the inaugural element of the permanent dentition to emerge, typically appearing at approximately six years of age. Due to its early exposure to the oral environment and its anatomical position, it is frequently cited as the most vulnerable tooth to early-onset dental pathology. Historically, longitudinal data [1] has indicated that the vast majority of FPMs exhibit significant clinical presence shortly after the initial eruption phase. A primary challenge in pediatric oral health is the frequent parental misconception that first permanent molars (FPMs) are deciduous teeth. This misunderstanding often leads to the erroneous belief that these teeth will eventually exfoliate and be replaced, resulting in significant clinical neglect [1, 2]. In reality, the FPM is the inaugural permanent tooth to emerge, typically appearing at approximately six years of age. It serves as the primary unit for masticatory function, maintains the structural integrity of the dental arch, and acts as the fundamental determinant of the occlusal relationship. The premature loss or compromise of these teeth can lead to severe orthodontic sequelae, including the pathological migration of adjacent teeth, generalized dental misalignment, and the development of an abnormal bite (malocclusion) [3, 4]. Furthermore, because eruption occurs during a developmental stage where manual dexterity is often insufficient for effective hygiene, these teeth are highly susceptible to early-onset decay. The high incidence of dental caries in the first permanent molars is attributed to their complex occlusal morphology, characterized by deep pits and fissures. These anatomical features provide a sheltered environment conducive to bacterial colonization and biofilm adherence, with bacterial activity accounting for up to 95% of carious lesions. Given that the progression of dental caries can be unpredictable, early diagnostic intervention is critical to prevent the transition from reversible symptoms to advanced pathology. Consequently, proactive screening and early treatment remain the most effective strategies for mitigating long-term dental complications [5–7]. Sombonnongbouathong Primary School, situated in the Sikottabong District of Vientiane, serves as a central educational hub for students from diverse surrounding villages. The school currently enrolls 173 students across five grade levels (Grades 1–5). This research is significant for the following reasons:

- **Strategic Planning:** It provides essential empirical data to inform the development of targeted oral health solutions.
- **Health Promotion:** The findings will facilitate the design of health education programs tailored for both students and guardians.
- **Intervention:** This data supports the justification for mobilizing dental units to provide on-site screenings and preventive care.
- **Academic Reference:** The study serves as a foundational reference for dental educators and researchers conducting future investigations into pediatric oral health within the Lao PDR.

2. Methodology

This research utilized a descriptive, cross-sectional study design to evaluate the prevalence and distribution of dental caries at a specific point in time. The primary objective was to collect and analyze quantitative data regarding the clinical status of the first permanent molars among the target population. The investigative protocol focused exclusively on the four first permanent molars, Maxillary: Teeth 16 and 26, Mandibular: Teeth 36 and 46. Clinical assessment was performed via visual inspection and tactile examination using a dental probe. Each tooth was systematically evaluated for the presence of caries, and the specific tooth surfaces (mesial, distal, occlusal, buccal, and lingual) were recorded where applicable. Raw clinical data obtained from the sample population were digitized and processed using SPSS Statistics (Version 20.0). The statistical analysis followed these procedures: Data were calculated to determine frequency distributions and percentages. Results were summarized to illustrate the incidence rate and anatomical distribution of caries across the four quadrants. The finalized findings are presented in structured statistical tables to facilitate clear interpretation of the dental health trends observed within the study group.

3. Result

3.1. Population Distribution

The study comprised a total sample size of 173 participants. A demographic breakdown of the population revealed a distribution of 101 males (58.4%) and 72 females (41.6%). The participants ranged in age from school-age children to early adolescents. The age distribution was characterized by the following: Primary Cohort The largest age group represented in the study was 10-year-olds, accounting for 25.4% (n=44) of the total sample. Secondary Cohort: This was followed by 8-year-olds, who constituted 21.3% (n=37) of the participants. Minority Cohort: The lowest frequency was observed among 13-year-olds, representing 2.8% (n=5) of the population. The comprehensive demographic profile, including gender and age stratification, is detailed in Table 1 below.

Table 1: Demographic Distribution of Participants by Age and Gender (N=173)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	101	58.4%
	Female	72	41.6%
Age (Years)	5	6	3.4
	6	16	9.2
	7	18	10.4
	8	37	21.3%
	9	29	16.7%
	10	44	25.4%
	11	12	6.9%
	12	6	2.8%
	13	5	2.8%
Total		**173**	**100.0%**

3.2. Sweet Food Consumption Patterns

The correlation between dietary habits and the incidence of dental caries was evaluated. Among the total sample, 143 participants reported a preference for sweet food consumption. Within this group, 75.5% (n=108) exhibited dental caries, while 24.5% (n=35) showed no clinical signs of decay. In contrast, among the 30 participants who reported no preference for sweet foods, 70.0% (n=21) presented with dental caries, and 30.0% (n=9) were caries-free.2. Consumption of Sugar-Sweetened Beverages. The study further analyzed the impact of sugar-sweetened beverage consumption on oral health: Sweet Drink Consumers: Of the 137 participants who frequently consumed sweet drinks, 76.7% (n=105) were diagnosed with dental caries, compared to 23.3% (n=32) without. Non-Consumers: Among the 36 participants who did not favor sweet drinks, 66.7% (n=24) presented with caries, while 33.3% (n=12) did not. Detailed findings regarding these behavioral factors and their clinical outcomes are presented in Table 2.

Table 2: Correlation Between Dietary Habits and the Incidence of Dental Caries

Variable	Category	Total (n)	Caries Present n (%)	Caries Absent n (%)
Sweet Food Consumption	Consumes	143	108 (75.5%)	35 (24.5%)
	Does Not Consume	30	21 (70.0%)	9 (30.0%)
Sweet Drink Consumption	Consumes	137	105 (76.7%)	32 (23.3%)
	Does Not Consume	36	24 (66.7%)	12 (33.3%)

3.3. Oral hygiene

Analysis of the sample population's oral hygiene practices revealed significant correlations between dental caries and the frequency, technique, and auxiliary methods of tooth brushing. Frequency of Tooth Brushing. The data indicates that brushing frequency is a critical factor in the prevalence of dental decay. Among participants with dental caries, the vast majority (77.9%) reported brushing their teeth twice daily. In contrast, those who remained free of dental caries demonstrated a higher frequency of oral care, with the largest portion (27.0%) brushing three times per day. Brushing Technique. Regarding mechanical technique, horizontal brushing was the most prevalent method across both cohorts. However, it was overwhelmingly associated with the presence of disease; 78.6% of individuals using the horizontal method presented with dental caries, compared to only 21.4% of the caries-free group. Auxiliary Oral Hygiene Methods. The use of supplementary oral cleaning methods (such as flossing or mouthwash) also showed a notable impact on dental health. Participants who utilized additional cleaning methods exhibited a caries rate of 77.6% (n = 87). Interestingly, the prevalence of caries remained high even among those who did not employ auxiliary methods, recorded at 68.8% (n = 42). The correlation between oral hygiene practices and dental caries prevalence is shown in Figure 3.

Table 3: Correlation Between Oral Hygiene Practices and Dental Caries Prevalence

Variable	Category	With Dental Caries (%)	Without Dental Caries (%)
Frequency	2 times/day	77.90%	22.10%
	3 times/day	73.00%	27.00%
Technique	Horizontal	78.60%	21.40%
Auxiliary Methods	Used	77.6% (n=87)	22.40%
	Not Used	68.8% (n=42)	31.20%

3.4. Dental Services

The study assessed the dental attendance patterns and primary reasons for seeking professional care among the participants. The findings indicate that 101 individuals (58.4%) had previously utilized dental services, whereas 72 participants (41.6%) reported having never visited a dentist.4.1% Primary Objectives for Dental Consultations. Among the cohort that had accessed professional care, the most prevalent reason for the visit was for tooth extraction, involving 72 individuals (71.2%). This was followed by general dental treatments, which accounted for 25 cases (24.8%). A small minority of participants (4.0%, n = 4) reported dental check-ups as their primary reason for visitation. The specific distribution of dental visits and the associated clinical motivations are detailed in Table 4.

Table 4: Distribution of Dental Service Utilization and Motivations for Consultation

Dental Attendance	Frequency (n)	Percentage (%)
History of Dental Visits	101	58.40%
Reason: Tooth Extraction	72	71.20%
Reason: Dental Treatment	25	24.80%
Reason: Check-up/Other	4	4.00%
No Prior Dental Visits	72	41.60%
Total	**173**	**100.00%**

3.5. Clinical Findings and Treatment Data

The clinical examination of the sample population provided a comprehensive overview of oral health status, specifically regarding the prevalence of dental caries and the occurrence of impacted teeth. Prevalence of Dental Caries and Impacted Teeth. Initial findings indicate that 129 participants (74.5%) presented with dental caries, while 40 individuals (23.1%) were classified as caries-free. Additionally, impacted

teeth were identified in 4 participants (2.3%). Cumulative Incidence within the Sample A broader analysis of the total clinical observations revealed that out of the total instances recorded, 295 cases (42.6%) were identified as dental caries, whereas 397 instances (57.3%) showed no evidence of decay. Impacted teeth accounted for 5 of the total clinical findings (0.72%). Detailed prevalence data and clinical distributions are synthesized in Table 5.

Table 5: Detailed prevalence data and clinical distributions

Clinical Condition	Frequency (n)	Percentage (%)	Cumulative Cases (n)	Cumulative Percentage (%)
Dental Caries	129	74.50%	295	42.60%
No Caries	40	23.10%	397	57.30%
Impacted Teeth	42	0.30%	50	72%
Total	**173**	**100.00%**	**697**	**100.00%**

3.6. Distribution of Dental Caries by Gender

The study analyzed the distribution of dental caries across the sample population, categorized by gender. The data reveals a higher prevalence of caries among male participants compared to female participants. Gender-Based Prevalence. According to the clinical results, males accounted for the largest proportion of the population affected by dental caries, with 75 individuals representing 58.0% of the total caries cases (comprising 60.0% of the male sub-group). In comparison, 54 female participants presented with dental caries, representing 42.0% of the total cases (comprising 40.0% of the female sub-group). Comprehensive details regarding the gender ratio and the distribution of caries are synthesized in Table 6.

Table 6: Gender Distribution and Caries Prevalence within the Sample Population

Gender	Frequency (n)	Proportion of Caries Cases (%)	Prevalence within Gender Group (%)
Male	75	58.0%	60.0%
Female	54	42.0%	40.0%
Total	129	100.0%	100.0%

3.7. Geographic Distribution of Dental Caries by Age and Sex

The analysis of the sample population reveals significant variance in the prevalence and severity of dental caries across different age groups. The findings indicate that 10-year-old participants exhibited the highest incidence of the condition, while the 5-year-old cohort recorded the lowest. Prevalence of Dental Caries: The highest frequency of dental caries was observed in the 10-year-old group, accounting for 38 individuals (29.5%). This was followed by the 8-year-old group with 28 individuals (20.2%). Conversely, the lowest prevalence was identified in 5-year-olds, representing only 3 individuals (2.3%). Total Carious Teeth: In terms of the total volume of affected teeth, 10-year-olds recorded the highest count at 82 teeth (27.9%), followed by 8-year-olds at 71 teeth (24.0%). The 5-year-old group maintained the lowest distribution, accounting for only 1.6% of the total affected teeth. The comprehensive breakdown of these geographic and demographic correlations is presented in Table 7 below.

Table 7: Distribution of Dental Caries by Age Group

Age Group	Number of Individuals	Percentage (%)	Number of Carious Teeth	Percentage (%) Total Teeth (%)
10 Years	38	29.5%	82	27.9%
8 Years	28	20.2%	71	24.0%
5 Years	3	2.3%	3	1.6%

3.8. Distribution of Dental Caries by Anatomical Location (Jaw)

The distribution of dental caries was analyzed based on the anatomical location within the oral cavity. The results distinguish between caries localized to the maxilla (upper jaw), the mandible (lower jaw), and instances where caries were present in both arches. The study found that the mandibular region exhibited a higher frequency of dental caries compared to the maxillary region. The specific breakdown of the data is as follows: Mandibular Caries (Lower Jaw): This region showed the highest prevalence, affecting 53 individuals (41.0%) and accounting for 180 total carious teeth (61.0%). Maxillary Caries (Upper Jaw): Caries in the maxilla were observed in 12 individuals (9.0%), with a total of 115 carious teeth (39.0%). Dual-Arch Involvement: A significant portion of the sample, 64 individuals (50.0%), presented with carious lesions in both the upper and lower jaws simultaneously. Detailed proportions regarding the distribution of caries by jaw are summarized in Table 8.

Table 8: Distribution of Dental Caries by Anatomical Location (Maxilla, Mandible, and Both Arches)

Anatomical	Number of Individuals (n)	Percentage of Sample (%)	Number of Teeth Affected	Percentage of total Caries (%)
Maxilla (Upper Jaw)	12	9.00%	115	39.00%
Mandible (Lower Jaw)	53	41.00%	180	61.00%
Both Arches	64	50.00%	-	-
Total	**129**	**100.00%**	**295**	**100.00%**

3.9. Prevalence of Dental Caries by Specific Tooth Position

The study findings, the highest prevalence of dental caries was observed in the mandibular first molars (teeth 36 and 46), with 90 affected teeth (52.0%), while 83 teeth (48.0%) remained sound. This was followed by the maxillary right first molar (tooth 16), which exhibited decay in 60 teeth (34.6%), with 113 teeth (65.4%) being non-carious. The lowest incidence was recorded in the maxillary left first molar (tooth 26), with 55 carious teeth (31.7%) and 118 non-carious teeth (68.3%). These distributions are detailed in Table 9 below.

Table 9: Distribution and Incidence Rate of Dental Caries Across First Molar Positions

Tooth Number (FDI)	Carious Teeth: n (%)	Non-Carious Teeth: n (%)	Total (n)
36 & 46 (Mandibular First Molars)	90 (52.0%)	83 (48.0%)	173
16 (Maxillary Right First Molars)	60 (34.6%)	113 (65.4%)	173
26 (Maxillary Left First Molars)	55 (31.7%)	118 (68.3%)	173

3.10. Distribution of Dental Caries by Tooth Surface

The study results indicate varying frequencies of dental decay across different surfaces of the first molars. The occlusal surface exhibited the highest prevalence on tooth 46, with 71 recorded cavities (31.4%). Regarding proximal surfaces, the mesial surface was most frequently affected on tooth 36 (12 cavities; 48.0%), while the distal surface showed the highest incidence on tooth 46 (14 cavities; 33.3%). For the smooth surfaces, the buccal surface showed an equal peak prevalence on teeth 36 and 46, each totaling 27 cavities (39.1%). The palatal surface of tooth 16 recorded the highest involvement within its category at 16 cavities (64.0%), and the lingual surface was most affected on tooth 36 with 6 cavities (54.5%). Detailed findings are presented in Table 10 below.

Table 10: Incidence of Dental Caries Categorized by Tooth Surface and Position

Surface	Most Affected Tooth (FDI)	Number of Cavities (n)	Percentage(%)
Occlusal	46	71	31.4%
Mesial	36	12	48.0%
Distal	46	14	33.3%
Buccal	36, 46	27	39.1%
Palatal	16	16	64.0%
Lingual	36	65	4.5%

3.11. Classification of Carious Teeth by Number of Affected Surfaces

The study findings indicate that the majority of affected first molars presented with single-surface involvement. Specifically, 223 teeth (75.5%) exhibited decay on one surface. Multi-surface involvement was less frequent: 57 teeth (19.4%) were affected on two surfaces, 5 teeth (1.7%) on three surfaces, and 4 teeth (1.4%) on four surfaces. Extensive decay involving five surfaces was observed in 6 teeth (2.0%). These data are summarized in Table 11.

Table 11: Frequency Distribution of Carious Lesions by Number of Affected Tooth Surfaces

Number of Surfaces	Frequency (n)	Percentage (%)
One Surface	223	75.5%
Two Surfaces	57	19.4%
Three Surfaces	5	1.7%
Four Surfaces	4	1.4%
Five Surfaces	6	2.0%
Total	**295**	**100.0%**

3.12. Distribution of Dental Caries Prevalence Within the Study Population

The analysis of the study sample identified a total of 129 individuals presenting with dental caries. Among this group, the distribution of carious lesions per individual varied: 48 participants (37.2%) exhibited two carious lesions, representing the largest subgroup. This was followed by 33 participants (25.5%) with a single carious lesion and 26 participants (20.3%) with three lesions. Further details regarding the remaining participants and the specific frequency of caries are presented in Table 12.

Table 12: Frequency of Dental Caries per Individual Among the Affected Population

Number of Carious Lesions	Number of Individuals (n)	Percentage (%)
1 Caries	33	25.5%
2 Caries	48	37.2%
3 Caries	26	20.3%
Tota Affected Populationl	129	100.0%

4. Discussions

Demographic Distribution and Prevalence

This cross-sectional descriptive study investigated the prevalence of dental caries in the permanent first molars of 173 primary school students in Sombonnongbouathong. The cohort comprised 101 males (58.4%) and 72 females (41.6%). Of these, 129 students presented with dental caries, with a slightly higher prevalence in males (58.0%) than in females (42.0%). These findings are consistent with [8], who reported a similar male-predominant trend in caries prevalence among children in Rafsanjan. Anatomical Distribution by Jaw Position. A total of 295 carious teeth were identified. Analysis by arch position revealed:

Mandibular 180 teeth (61.0%), Maxillary : 115 teeth (39.0%).

This distribution aligns with [7], which observed a higher incidence in the lower jaw (342 mandibular vs. 210 maxillary). The increased susceptibility of mandibular first molars is attributed to their complex occlusal anatomy and larger root morphology, which facilitate the retention of microbial plaque and food debris. Frequency of Affected Teeth per Individual. The study found that 37.2% of affected students had two carious molars, which was the most frequent observation. This contrasts with studies by Mubaraki [9] and Liu & Xu, where single-molar involvement was most common (40.5%). Such discrepancies are likely due to regional differences in socioeconomic development, dietary habits, and age groups. Tooth-Specific Incidence and Surface Involvement.

The highest incidence of decay was observed in teeth 36 and 46 (52.0% each), followed by tooth 16 (34.6%) and tooth 26 (31.7%). This mirrors the findings of [10], where mandibular molars showed the highest caries density. Regarding surface involvement, the occlusal surface was the most frequently affected (226 surfaces), followed by the buccal (69) and distal (42) surfaces. This is consistent with Tadakamadla et al. (2023), confirming that the pits and fissures of the occlusal surface represent the highest risk area for caries initiation. Behavioral and Risk Factor Analysis.

Dietary habits played a significant role; among the 143 students who frequently consumed sweets, 108 (75.5%) presented with caries. This correlates with the findings of [11], where children favoring sweet foods exhibited a 73.8% decay rate. Interestingly, this study found nearly identical caries rates between children who brushed once daily (71.0%) and those who brushed three times daily (73.1%). This contradicts the findings of Lin Que [11] where increased brushing frequency ,typically led to decreased decay rates. This anomaly suggests that quality and technique of brushing, rather than frequency alone, are decisive. Contributing factors may include: Improper brushing duration or technique.

Post-brushing behaviors (e.g., consuming milk or sugar before sleep).

Lack of parental supervision in maintaining daily oral hygiene routines.

5. Conclusion

This cross-sectional study investigated the prevalence of dental caries in the permanent first molars of a school-aged cohort. The study sample comprised 173 participants, consisting of 101 males (58.4%) and 72 females (41.6%). Summary of Clinical Findings. The analysis revealed a high prevalence of dental pathology within the sample: Carious Teeth: 129 participants (74.5%) presented with active decay. Sound (Non-carious) Teeth: 40 participants (23.1%). Impacted Teeth: 4 participants (2.3%). Demographic trends indicated that males exhibited a slightly higher caries prevalence, accounting for 58.0% (n=75) of the affected group. The peak prevalence was observed in the 10-year-old age group, representing 29.5% (n=38) of the total carious cases. Risk Factors and Anatomical Susceptibility. Dietary and behavioral assessments identified significant risk factors: Dietary Habits: 143 participants reported a preference for sweets, while 137 participants frequently consumed sugar-sweetened beverages. Healthcare Utilization: 112 participants practiced regular oral hygiene, and 101 participants (58.4%) had previously sought professional dental consultation. Regarding anatomical distribution, the mandibular first molars (teeth 36 and 46) exhibited the highest susceptibility, with 90 carious lesions each (52.0%). The occlusal surface was the most frequently affected site, with 226 recorded lesions, highlighting the vulnerability of the pits and fissures in early permanent dentition. Public Health Implications. Although this study was conducted within a specific timeframe, the data collected is instrumental for the strategic planning of Mobile Dental Units at the Faculty of Dentistry, University of Health Sciences. These findings underscore the necessity of targeted oral health promotion and preventive interventions for schoolchildren. By prioritizing early diagnosis and education, we aim to

ensure that the Lao population achieves improved oral and systemic health, fostering a healthier and more robust foundation for the nation's future development.

Article Information

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