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Risk Factors for First Molar Caries in 8-12-Year-Olds: A Cross-Sectional Study

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ABSTRACT

Background: First permanent molar is the first tooth to erupt in oral cavity so more prone to dental caries. Many risk factors are responsible for this tooth susceptibility to caries like lack of awareness and financial resources.
Objective: To determine the distribution of risk factors for dental caries in first permanent molars among children aged 8-12 years.
Materials and Methods: A cross-sectional study was conducted on 236 children at Saidu College of Dentistry, using nonprobability consecutive sampling. Children aged 8-12 years in the mixed dentition stage were included. Exclusion criteria were physically/mentally handicapped children or those with medical conditions like leukemia and hemophilia. Data were collected through parent interviews and oral examinations using the decayed missing and filled teeth (DMFT) index. Chi-square test was run to determine association.
Results: The mean age of the patients was 10.25±3.1 years with more females (n = 134, 56.78%) than males (n = 102, 43.22%). Females consumed sugary foods more frequently, with 47 (35.07%) consuming them 3-4 times daily, compared to 25 males (24.51%) ($p < 0.001$). Males (n = 49, 48.04%) consumed beverages 1-2 times daily more frequently than females (n = 15, 11.19%) ($p < 0.001$). Rural participants had significantly higher sugary food intake ($p < 0.001$), lower tooth brushing frequency ($p < 0.001$), and more frequent snacking ($p < 0.001$) compared to urban participants, who showed greater awareness of caries prevention ($p = 0.002$)
Conclusion: Dental caries was highly frequent among 8–12-year-olds, with significant correlations to sugar intake, tooth brushing habits, caries prevention awareness, and snacking.
Keywords: Children, Dental carries, First permanent molar, Pediatric dentistry, Risk factors

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INTRODUCTION

Dental caries remains a significant public health issue, despite serious efforts to lower their prevalence among children and adolescents. A recent systematic review and meta-analysis indicates that the overall prevalence of dental caries in children is 46.2% for primary teeth and 53.8% for permanent teeth. The highest prevalence rates are observed in Africa and Asia, while the lowest rates are found in Europe.[1] The primary dietary factor associated with the development of dental caries is sugar consumption.[2] Inadequate treatment for dental caries can cause discomfort and infection, negatively impacting children's physical and mental well-being.[3]

Furthermore, dental caries can require lifetime care, which has a substantial financial impact on patients and healthcare systems.[4] Even with great progress made in prevention, dental caries remains one of the most prevalent chronic illnesses impacting children globally.[5] A vital tooth in the dental arch, the first permanent molar (FPM), usually erupts between the ages of 6 and 7. FPM is more prone to caries than other teeth because of its morphological and functional traits as well as environmental variables.[6] Hence, the early loss of FPM due to caries impacts individuals' future oral and dental health.

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Children are the ones who suffer from dental decay the most, yet most of these teeth are extracted because treatment for them is costly and there aren't enough resources. In 2000, the World Health Organization (WHO) set a global target for dental caries to be no more than an average of three DMFT (decayed, missing, or filled teeth) by the time a child was twelve years old.[7] The WHO stated in 2007 that dental caries affect 60–90% of schoolchildren globally.[8,9] Dental care has been a big public health concern as well as a huge economic issue in developing nations. It was projected that 22.7% of Indians were between the ages of 5 and 14 in 1997.[10] There have been a few research on dental health conducted in Pakistan.[11]

A DMFT score of 0.8 was reported in Multan among children aged 12 to 15.[12] Like this, Khan noted a DMFT score of 0.9 and stated that caries in first molars affected 83% of all children with decay.[13]

Despite extensive research on dental caries, there remains a significant gap in studies focusing specifically on the first permanent molar (FPM) in children aged 8 to 12 in Khyber Pakhtunkhwa. The FPM plays a crucial role in oral health, and its early loss can have long-term consequences. The unique dietary habits, oral hygiene practices, and socio-economic conditions in this region necessitate a targeted investigation. By identifying the frequency of caries in FPMs and understanding the associated risk factors, this study aims to provide critical insights that can guide the development of tailored preventive measures, early intervention strategies, and educational programs. These findings will be instrumental in improving oral health outcomes for this vulnerable population and reducing the long-term burden of dental diseases in the region.

The objective of this study was to determine frequency of risk factors of dental caries in first permanent molars among 8 - 12-year-old children.

MATERIALS AND METHODS

This cross-sectional study was conducted at Operative Dentistry, Saidu College of Dentistry from December 15, 2023, to May 15, 2024. The participants were recruited from the Outpatient Department, Saidu College of Dentistry, Swat, using non-probability consecutive sampling technique. Ethical approval was obtained from the Ethical Committee (17-ERB/024, dated:27-2-2024). Written informed consent was obtained from the parents/guardians of all participants.

The inclusion criteria were children between 8 and 12 years of age in the mixed dentition stage, of both genders, and Pakistani nationals with at least one carious first permanent molar. The exclusion criteria included mentally and physically handicapped patients, as well as medically compromised patients (those suffering from leukemia or hemophilia, assessed through history such as medication use and treatment from a physician or hematologist). A sample size of 176 participants was calculated using openepi software using 20.69% brushing from previous study with 6% margin of errors, at 95% confidence interval and 80% power.[14] To increase further the power of the study we included 236 participants.

Data collection involved administering a structured questionnaire to the accompanying adult of each child, conducted by a trained dentist. The children and their parents received separate awareness sessions prior to the dental assessment, based on the parents' comprehension level. The questionnaire was designed to collect demographic and lifestyle-related information to assess risk factors for dental caries in children. It included basic demographic details such as the child's name, age, sex (female or male), and area of residence (rural or urban). Dietary habits were evaluated through variables like sugary food intake per day, categorized as 1–2 times, 3–4 times, 5 or more times, or none, and snacking frequency between meals, recorded as frequently or occasionally. Oral hygiene practices were assessed by the frequency of tooth brushing, categorized as not daily, once, or twice a day. Beverage consumption was also recorded, with options of 1–2 times, 3–4 times, or none per day. Additionally, awareness regarding caries prevention was assessed, with responses categorized as aware, not aware, or somewhat aware.

Following approval, an intra-oral examination was performed by the author, who received specific training to minimize inter-examiner variability. The dental status of each child was assessed using a standard mouth mirror and blunt probe, with tooth surfaces dried using a cotton pellet for better visibility. The dental caries status was evaluated using the DMFT (Decayed, Missing, and Filled Teeth) index for permanent teeth and the deft (decayed, extracted, and filled teeth in primary dentition) index, providing a comprehensive overview of the participants' oral health.

SPSS 23 was used for data analysis. Categorical variables were expressed as numbers and percentages. The tests of significance used were the chi-square test. The association between risk factors of dental caries and confounders like gender and residence was determine using chi-square test/Fisher exact test. Statistical significance was set at $P < 0$.

RESULTS

The mean age of the participants was 10.25±3.1 years. The study sample consisted of more females (n = 134, 56.78%) than males (n = 102, 43.22%). Participants were nearly equally divided between rural (n = 116, 49.15%) and urban (n = 120, 50.85%) areas. Regarding sugary food intake, the most common frequency was 1–2 times per day (n = 77, 32.63%), followed by 3–4 times per day (n = 72, 30.51%). A smaller proportion consumed sugary foods 5 or more times daily (n = 47, 19.92%), while 40 participants (n = 40, 16.95%) reported no intake. In terms of tooth brushing, the most frequent habit was brushing once daily (n = 96, 40.68%), followed closely by participants who did not brush daily (n = 91, 38.56%), and only a few brushed twice a day (n = 49, 20.76%). For beverage consumption, the most common patterns were 2 times per day (n = 64, 27.12%) and 3–4 times daily (n = 63, 26.69%), with 46 participants (n = 46, 19.49%) reporting no daily intake. Awareness of caries prevention was highest among those who were somewhat aware (n = 112, 47.46%), while others were unaware (n = 76, 32.20%), and only a small number were fully aware (n = 48, 20.34%). Snacking between meals was reported frequently by most participants (n = 160, 67.80%), while the rest snacked occasionally (n = 76, 32.20%). (Table 01)

Females consumed sugary foods more frequently, with 47 (35.07%) reporting intake 3-4 times daily and another 47 (35.07%) consuming 5 or more times, while no males reported such high intake. In contrast, 25 males (24.51%) consumed sugary foods 3-4 times daily ($p < 0.001$). Tooth brushing habits also varied significantly ($p < 0.001$), with 91 males (89.22%) not brushing daily, whereas all females brushed at least once, with 85 (63.43%) brushing once and 49 (36.57%) brushing twice daily. Beverage consumption was also significantly different ($p < 0.001$), as 49 males (48.04%) consumed beverages

1-2 times daily, compared to only 15 females (11.19%). Additionally, 32 females (23.88%) and 31 males (30.39%) consumed beverages 3-4 times daily. There was no significant difference in awareness of caries prevention ($p = 0.2$). Snacking habits differed markedly ($p < 0.001$), with all 102 males (100%) frequently snacking between meals, while 58 females (43.28%) reported frequent snacking and 76 (56.72%) snacked only occasionally. (Table 02)

Analysis by area of residence revealed significant differences in sugary food intake per day ($p<0.001$), with rural participants consuming sugary foods more frequently. Tooth brushing frequency also differed significantly ($p<0.001$), with rural participants brushing less frequently. Beverage consumption varied significantly ($p<0.001$) between rural and urban participants. Awareness of caries prevention showed significant differences ($p=0.002$), with urban participants being more aware. Snacking between meals was significantly more frequent in rural participants ($p<0.001$). (Table 03)

Table 01. Distribution of demographics, sugary food intake, tooth brushing, beverages/day

Characteristic	N = 236 (%)
Gender	
Female	134 (56.78)
Male	102 (43.22)
Area of Residence	
Rural	116 (49.15)
Urban	120 (50.85)
Sugary Food Intake/Day	
1-2 times	77 (32.63)
3-4 times	72 (30.51)
5 or more	47 (19.92)
None	40 (16.95)
Tooth Brushing/Day	
Not Daily	91 (38.56)
Once	96 (40.68)
Twice	49 (20.76)
Beverages/Day	
1 time	64 (27.12)
2 times	63 (26.69)
3-4 times	63 (26.69)
None	46 (19.49)
Awareness of Carries Prevention	
Aware	48 (20.34)
Not Aware	76 (32.20)
Somewhat Aware	112 (47.46)
Snacking between Meals	
Frequently	160 (67.80)
Occasionally	76 (32.20)

Table 02. Distribution of risk factors of Dental carries

Characteristic	**Female**, N = 134 (%)	**Male**, N = 102 (%)	p-value*
Sugary Food Intake/Day			<0.001
1-2 times	0 (0.00)	77 (75.49)	
3-4 times	47 (35.07)	25 (24.51)	
5 or more	47 (35.07)	0 (0.00)	
None	40 (29.85)	0 (0.00)	
Tooth Brushing/Day			<0.001
not daily	0 (0.00)	91 (89.22)	
Once	85 (63.43)	11 (10.78)	
Twice	49 (36.57)	0 (0.00)	
Beverages/Day			<0.001
1 time	15 (11.19)	49 (48.04)	
2 times	59 (44.03)	4 (3.92)	
3-4 times	32 (23.88)	31 (30.39)	
None	28 (20.90)	18 (17.65)	
Awareness of Carries Prevention			0.2
Aware	32 (23.88)	16 (15.69)	
not aware	44 (32.84)	32 (31.37)	
somewhat aware	58 (43.28)	54 (52.94)	
Snacking between Meals			<0.001
Frequently	58 (43.28)	102 (100.00)	
Occasionally	76 (56.72)	0 (0.00)	

*Pearson's Chi-squared tests

Table 03. Comparison of risk factors of Dental carries

Characteristic	**Rural**, N = 116[1] (%)	**Rural**, N = 120[1] (%)	p-value[2]
Sugary Food Intake/Day			<0.001
1-2 times	77 (66.38)	0 (0.00)	
3-4 times	39 (33.62)	33 (27.50)	
5 or more	0 (0.00)	47 (39.17)	
None	0 (0.00)	40 (33.33)	
Tooth Brushing/Day			<0.001
not daily	91 (78.45)	0 (0.00)	
Once	25 (21.55)	71 (59.17)	
Twice	0 (0.00)	49 (40.83)	
Beverages/Day			<0.001
1 time	49 (42.24)	15 (12.50)	
2 times	18 (15.52)	45 (37.50)	
3-4 times	31 (26.72)	32 (26.67)	
None	18 (15.52)	28 (23.33)	
Awareness of Carries Prevention			0.002
Aware	16 (13.79)	32 (26.67)	
not aware	32 (27.59)	44 (36.67)	
somewhat aware	68 (58.62)	44 (36.67)	
Snacking between Meals			<0.001
Frequently	116 (100.00)	44 (36.67)	
Occasionally	0 (0.00)	76 (63.33)	

*Chi-squared tests/fisher exact test

DISCUSSION

The study contributes to the body of knowledge on risk factor of dental caries in the first permanent molar among children in Swat.

Caries affects most of the children in the industrialized countries so its studies in different regions is crucially important. The comparison of these results with different studies is made and its frequency is also compared with several other areas around the World.[15] The Smile Pakistan- Survey of Oral Health in school going children conducted in 1986 in different regions of Pakistan showed 95.0% prevalence.[16] The results of this study were alarming for juvenile oral health care policies, but it had a few limitations being a pilot study, so it was underestimated. Then some other pilot studies were conducted to determine the severity of problem.[17] These findings reveal that dental caries remain a significant issue among children, underscoring the importance of regional studies and better oral health care policies to tackle this growing problem effectively. The study of Mubaraki et al. conducted in 2002 in Saudi Arabia shows the caries frequency of 64.0%. The study conducted in 2006 on school children at Al-coast province at Saudi Arabia shows the caries frequency of 69.0%.[17] So being a less underdeveloped region the results of this study are not so bad, particularly in comparison to these results.[18] The Somali and Vietnamese migrant, Middle East children in Rome and Grahamstown town children are the other few examples of children affected from poor oral hygiene and dental caries.[19]

Significant findings in this study are that the rate of dental caries was significantly high among children older than 6 years compared to younger children with mean age of 10.25. This may be due to longer duration of exposure to causative factors of dental caries and cumulative effect of poor oral hygiene practice over time.[20] These findings are in line with the results of previous study by Emmanuelli et al.[21] in Basel which found that the prevalence of dental caries increases with increase in age among pediatric population.

This study also points out the role of food in the promotion of dental caries with ,32.6% of children consuming sugary food 1-2 times,30.51% children consuming 3-4 times. Cariogenic food intake was observed among those children who had higher consumption of sweets and sweetened beverages, which made them more susceptible for the onset of caries. It is in conformation with recommendations of World Health Organization (WHO), emphasizing limitation in sugar consumption and healthy food promotion.[20]

Another statistically significant factor related to dental caries was frequency of toothbrushing. Children who brushed their teeth less frequently had higher caries prevalence, which emphasizes the important role of routine toothbrushing in sustaining oral health. They reported that 40.68% of children brush only once while 38.6% of children did not brush daily, only 20.69% children brush twice. This is consistent with the guidelines set by the American Dental Association that suggest brushing at least twice daily with fluoride toothpaste to avert dental caries.[21]

The gender distribution skewed towards females, with 56.78% being females. This gender distribution pattern is common in dentistry, where historically, there has been a higher carries frequency in females.[19] Although our study had a reasonably sized sample of children from both urban and rural localities of Swat, had assessed a comprehensive list of factors associated with dental caries.

Limitations

There are several limitations to this study: it uses a cross-sectional design, so cannot establish causality; self-reported data may introduce recall bias when reporting dietary habits or oral cleanliness behaviors, which can affect accuracy due to the inherent unreliability of such data; and non-probability sampling for subject recruitment means that these results may not be generalizable. Furthermore, since this study was conducted at a single center and lacks longitudinal data, the generalization of these findings may be limited.

The study has strengths like this explores the burden of dental caries in Swat, a region with limited education and awareness on oral health. Using a calculated sample size and a custom questionnaire, it provides valuable insights into the prevalence and risk factors of caries in children's first permanent molars.

CONCLUSION

Common risk factors for dental caries in first permanent molars include high sugary food intake, inadequate tooth brushing habits, and frequent snacking between meals. Females exhibited higher sugary food consumption and better brushing habits compared to males. Increased awareness of caries prevention is essential, particularly in rural areas, to improve overall oral health outcomes.

Ethical consideration

This study was approved by Institutional Review Board of Saidu College of Dentistry (17-ERB/024), Swat, Pakistan.

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Conflict of Interest

Authors declared no conflict of interest.

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DATA SHARING STATEMENT: The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

AUTHORS' CONTRIBUTION

The following authors fulfill authorship criteria as per ICMJE guidelines;

Rahman FU, Alam F: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

Qureshi R, Zohaib M: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

Ubaid W: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.

Gul K: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

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