



Comparison of Prevalence of Dental Caries among Schoolchildren of Urban and Rural Rawalpindi

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Abstract

Objective: Oral health status of children hailing from rural, peri-rural, and urban areas of Rawalpindi District was recorded, in relation to the prevalence of dental caries and its associated dentition status, for the purpose of generating epidemiologic data.

Materials and Methods: In this study, 1025 children from six private and public schools in rural, peri-rural, and urban areas of Rawalpindi District were recruited using clustered sampling technique and were orally examined for the identification of filled and/or decayed teeth as well as for teeth missing due to caries, as part of Foundation University Islamabad's outreach and community service campaign. Four calibrated examiners evaluated the prevalence of dental caries among schoolchildren and the decayed, missing, and filled teeth (DMFT)/decayed and filled teeth (dft) index was used to score teeth of children aged 12 and 6 years.

Results: Of the 6-year-old children, 66.1% had caries, predominantly untreated, and of the 12-year-old children, 71.3% reported a carious lesion with predominantly filled teeth. A mean DMFT of 0.65 ± 1.28 SD and a dft of 9.85 ± 5.44 SD were observed. No significant difference between caries experience between the two genders was observed in urban or peri-rural areas. In rural areas of the district, the prevalence of caries was moderately higher in 6- and 12-year-old boys than in girls.

Conclusion: The high values of dft may be attributed to high levels of disease and the presence of unaddressed oral health concerns in rural, peri-rural, and urban areas of the Rawalpindi District. This high prevalence of decayed, untreated teeth in primary dentition suggests widespread dental issues that need to be addressed to alleviate the burden of dental caries when these children enter adulthood. A strong need for caries management strategies among rural/peri-rural school-going children, in particular, is required.

Keywords: Children, dental caries, DMFT, epidemiology, prevalence



Introduction

Oral health is a primary component of an individual's general health and well-being.[1] Tooth decay or "dental caries" is a chronic oral disease that continues to pose a serious public health challenge. Despite being entirely preventable and advancements in medical/dental health-care to counter it being available, the incidence of dental caries continues to increase irrespective of ethnicity, gender, age, and socioeconomic status.[2-5] According to the World Health Organization, an estimated 3.5 billion people and nearly 60%-90% of school-going children in the developed or developing countries experience dental caries.[4,6,7] Sequelae of this dental disease, particularly if untreated, include discomfort, pain, functional impairments and eventual tooth loss, financial and economic burden on parents/caregivers, and psychosocial implications such as growing anxiety, fear, and reduced self-esteem, all of which significantly impact the quality of life and well-being of the children.[7-9]

Considering the prominent role of health beliefs and behaviors acquired during primary school ages in influencing the hygiene habits of individuals throughout their lifetime, focused efforts toward mapping the burden and determinants of dental caries in the said age group are of great importance and are identified in the scientific literature.[10]

Pakistan is a lower-middle income developing country, often faced with many sociopolitical challenges that influence the public health outcomes of its population. Although communicable diseases such as malaria and polio remain the predominant health crises affecting the largest population in Pakistan,[11] underlined by poverty, high illiteracy rates, and malnourishment, the oral health status and levels of dental diseases have remained, up to a point, static.[12] The overall prevalence of dental caries in Pakistan is 56.32%.[13] However, it has been reported that the severity of caries among individuals becomes significantly higher with increasing age.[12]

In Pakistan, information about the burden of oral diseases is scarce; however, the issue of limited availability of care and unmet oral health needs is well documented.[13] The number of dental professionals in the country may have increased in the past two decades, but the estimated dentist-to-population ratio is close to 1:25 000, even being as low as 1:200 000 in some rural areas and urban slums. Thus, the majority of the population in Pakistan dwelling in rural or peri-rural geographical locations has limited access and funds for oral health care provisions.[13]

It is worth mentioning that primary school enrollments in Pakistan are over 80%.[14] As reported by the Pakistan Social and Living Measurement Survey, there is 78% school attendance in urban schools and 51% in rural schools, irrespective of the level of education.[14] These statistics indicate that at least one-third of the country's population is enrolled in primary schools and may depart from secondary school education later in life. Therefore, oral health education for schoolchildren and mapping of oral health in primary school children can provide some context about the current situation of the oral health status and predict future trends of the burden of dental caries among Pakistanis.[15]

While the number of practicing dentists and pediatric dental specialists has seen an increase in the country, the practice of treating dental concerns of children and imparting oral health education to children in clinics and community services remains neglected or mal-distributed. Although oral health education can be provided with continuity within a school system by engaging trained, motivated schoolteachers and displaying educational conviction through role plays and self-examples, it continues to be sporadic and limited to professional pediatric dental care in Pakistan.[16]

This study aimed to determine the prevalence of dental caries among school-going children in Rawalpindi to develop strategies to support and promote systematic oral health education in both rural and urban schools. The study also aimed to assess the burden of this preventable disease in relation to the socioeconomic status of the families represented by their geographical location of residence and food security.

Materials and Methods

This longitudinal study was conducted among school-going children, aged 6 years (grade 1 or 2) and 12 years (grade 6 or 7), attending public or private schools in rural and urban communities of the twin cities. Clustered sampling technique was used to perform the study. For this study, a geographical division of rural and urban Rawalpindi was created using the city district government map and local government structure.[17,18] Based on this distribution, a list of rural and urban union councils was created using Microsoft Excel. Using computer-generated numbers, two rural and two urban union councils of Rawalpindi were randomly selected. Information from the census reports and the annual status of education reports was used to create a list of public and private schools in each short-listed union council. From the list, one rural and one

urban primary school from each rural and urban union council of Rawalpindi were selected. The children from the selected schools were screened for the purpose of mapping of the oral health status of the children.

A total sample size of 1863 schoolchildren was collected. Of these schoolchildren, 1026 children aged 6 and 12 years were screened for 2 years. The children were screened after having their parents/caregivers sign the consent form.

Inclusion criteria

- Children of both genders
- Children with all deciduous, permanent, and mixed dentition
- All 6- and 12-year-old children (according to their date of birth and last birthday as recorded on the day of data collection)
- Healthy children

Exclusion criteria

- Children of ages other than 6 and 12 years
- Children with extreme apprehension about oral examination
- Children with special healthcare needs

Ethical considerations and funding

There were no ethical concerns arising from this study, and ethical approval was obtained from the ERC committee at Foundation University Islamabad (ERC No.: FF/FUCD/632/ERC 026) prior to conducting this study.

Parents/caregivers who could not read or sign the consent form were asked to accompany the children to the schools, where their verbal consent was obtained and registered using their thumb impressions on the consent form. Children were then subjected to oral examinations once consent was obtained.

Data collection and calibration of examiners

All selected children underwent oral examinations in the classrooms, following the universal safety precautions. Dental status was recorded using the WHO oral health assessment form for children, 2013.[19] Clinical examinations were performed by a team of four calibrated examiners, having an interexaminer kappa statistic of 0.89-0.91, suggestive of reasonable interrater reliability. The calibrated examiners were licensed dental practitioners working as faculty members or post-graduate trainees at Foundation University College of Dentistry. An examination set (e.g., mirror and tweezer probe) was used to examine the students on portable folding chairs under natural light. The examination was

performed systematically per the WHO criteria for oral examination in a survey for decayed, missing, and filled teeth (DMFT). Students without a signed consent form were not examined.

Upon completion of the examination, each student was provided with a care package containing toothpaste, toothbrush, and oral health literacy infographic brochures in English and Urdu, depending on the comprehensibility of the child.

A total of eight trips were made for data collection, and an average of 150-200 students were examined every day. Foundation University Islamabad reimbursed all travel expenses incurred during these visits.

The index used to record the dentition status of 6-year olds having primary dentition was decayed and filled teeth (dft). The DMFT was reformatted to dft to avoid confusion about recording deciduous missing teeth, which might be due to the physiological shedding of teeth. For 12-year olds having mixed dentition, DMFT and dft were used to record dentition status.

Data analysis

The data were entered and analyzed by data management software IBM SPSS (version 23.0). The descriptive statistics for the categorical variables were presented as frequency and percentage, while the mean and standard deviation were reported for continuous variables. The categorical groups were compared using the Chi-squared test, whereas mean values were compared using the independent samples t-test. A value of $p \leq 0.05$ was considered significant.

Results

Of the 1025 children involved in the oral health mapping study, 505 lived in urban areas, 269 lived in peri-rural areas, and 251 were from rural areas. A total of 519 (50.6%) boys and 506 (49.4%) girls participated in the study. There were 558 (54.4%) children in the age group of 6 years and 467 (45.6%) children in the age group of 12 years.

The prevalence of caries among children with at least one carious primary or permanent tooth was 55.1% (565/1025). Among children in the 6-year age group, the prevalence of caries was noted to be 62.0% (346/558), whereas it was 46.9% (219/467) in the 12-year age group. No significant difference was found in the prevalence of dental caries between urban-dwelling male children of 6 years and 12 years ($p=0.259$), urban-dwelling female children of 6 years and 12 years ($p=0.148$), peri-rural dwelling male children of 6 years and 12 years

($p=0.370$), peri-rural dwelling female children of 6 years and 12 years ($p=0.761$), rural-dwelling male children of 6 years and 12 years ($p=0.993$), and rural-dwelling female children of 6 years and 12 years ($p=0.762$).

The mean dft score of primary teeth among children in the 12-year age group was higher than that of the 6-year age group ($p<0.007$), as shown in Table 1. The dft score was calculated to be 9.8 ± 5.4 , whereas the mean DMFT score of permanent teeth was found to be 0.65 ± 1.2 , as shown in Table 2. A significant difference was observed in mean DMFT scores of permanent teeth among children of different age groups, which means that children in the age group of 12 years had a higher score than those in the 6-year age group ($p<0.001$).

Subgroup analysis revealed that the DMFT permanent teeth score was higher in 12-year-old male children than in 6-year-old male children ($p<0.001$). The dft primary teeth score was also significantly higher in male children in the 12-year age group than in the 6-year age group ($p<0.001$). Similarly, higher DMFT/dft scores for both permanent and primary teeth were observed among female children in the 12-year age group than in the 6-year age group (Table 2). On the other hand, subgroup analysis, with respect to gender and area of residence, revealed that decayed, missing, and filled teeth score of both primary and permanent teeth was significantly higher in children living in rural areas than those living in urban and peri-rural areas ($p=0.005$ vs $p=0.038$). However, no significant difference was found in DMFT/dft scores of permanent and primary teeth of females in rural, urban, and peri-rural areas (Table 3).

Difference in DMFT and dft scores for both primary and permanent teeth was observed between males and females in 6-year and 12-year age groups, living in urban areas where the score was higher for the 12-years age group. Similarly, among children in peri-rural areas, the DMFT scores were higher for males and females of in the 12-year age group. These findings are summarized in Table 4.

Discussion

Tooth decay and loss, as reflected by the dentition status through oral examinations of children, are critical oral health indicators of both individual and community oral health.[20]

The purpose of this study was to obtain and assess information on the oral health status of school-going children in Rawalpindi, to facilitate focused oral health promotion strategies and promote a good quality of life for future generations in conjunction with optimal

Table 1. Decayed, missing, and filled teeth score of primary and permanent teeth with respect to gender, age, and residence area

	DMFT score (permanent teeth)		dft score (primary teeth)	
	Mean±SD	p	Mean±SD	p
Overall score	0.65±1.28	-	9.85±5.44	-
Gender				
Male	0.711±1.41	0.129	10.01±5.31	0.167
Female	0.58±1.14		9.61±5.57	
Age group				
6 years	0.30±0.84	<0.001	6.66±3.87	<0.001
12 years	1.06±1.57		13.66±4.53	
Area				
Urban	0.61±1.32	0.075	9.83±5.39	0.007
Peri-rural	0.57±1.11		9.14±4.88	
Rural	0.80±1.41		10.65±6.01	

DMFT: Decayed, missing, and filled teeth, dft: Decayed and filled teeth

Table 2. Comparison of decayed, missing, and filled teeth score among males and females with respect to age groups

Gender	DMFT score (permanent teeth)	p	dft score (primary teeth)	p
Male (n=519)				
Age group				
6 years	0.31±0.94	<0.001	6.82±3.99	<0.001
12 years	1.11±1.67		13.3±4.36	
Female (n=506)				
Age group				
6 years	0.29±0.744	<0.001	6.5±3.75	<0.001
12 years	1.00±1.43		14.01±4.71	

DMFT: Decayed, missing, and filled teeth, dft: Decayed and filled teeth

oral healthcare provisions. As Pakistan is a developing country with evolving population census systems and lacks valid registries, a purely random sample was difficult to achieve. Therefore, a representative, generalizable sample of 1025 students from schools in urban, rural, and peri-rural locations of Rawalpindi District was utilized. For this study, a modification in the WHO pathfinder survey approach was used to include the participation of the dominant ethnicity in urban, rural, and peri-rural focal locations.[21] The sample size, power, and high response rate further complement the generalizability of the results of this survey-based study. Moreover, the WHO indicator age groups (i.e., 6-year-old and 12-year-old children) were recruited in this study, per the global standards for measurement of dental caries experience.[22]

Table 3. Comparison of decayed, missing, and filled teeth score among males and females with respect to the area of residence

Gender	Area	DMFT score (permanent teeth)	p	dft score (primary teeth)	p
Male (n=519)	Residence				
	Urban	0.71±1.57	0.038	10.28±5.49	0.005
	Peri-rural	0.46±0.900		8.77±4.72	
	Rural	0.91±1.42		10.85±5.31	
Female (n=506)	Residence				
	Urban	0.49±0.95	0.233	9.32±5.24	0.190
	Peri-rural	0.66±1.18		9.44±5.00	
	Rural	0.68±1.39		10.43±6.77	

DMFT: Decayed, missing, and filled teeth, dft: Decayed and filled teeth

Table 4. Comparison of Decayed, missing, and filled teeth score between subgroups of urban, peri-rural, and rural areas with respect to gender and age group

Residence	Gender	Age	DMFT score (permanent teeth)	p	dft score (primary teeth)	p
Urban (n=505)	Male (n=266)	Age group				
		6-8 years	0.17±0.65	<0.001	6.18±4.05	<0.001
		9-12 years	1.12±1.91		13.36±4.28	
	Female (n=239)	Age group				
		6 years	0.155±0.38	<0.001	6.51±3.72	<0.001
		12 years	0.94±1.24		12.98±4.64	
Peri-rural (n=269)	Male (n=119)	Age group				
		6 years	0.22±0.73	<0.001	6.67±3.80	<0.001
		12 years	0.84±1.02		12.22±4.04	
	Female (n=150)	Age group				
		6 years	0.54±1.07	0.050	7.33±3.18	<0.001
		12 years	0.97±1.42		15.22±4.52	
Rural (n=251)	Male (n=134)	Age group				
		6 years	0.61±1.38	0.007	7.97±3.90	<0.001
		12 years	1.27±1.40		14.29±4.62	
	Female (n=117)	Age group				
		6 years	0.13±0.39	<0.001	4.82±4.39	<0.001
		12 years	1.12±1.72		14.92±4.66	

DMFT: Decayed, missing, and filled teeth, dft: Decayed and filled teeth

The method of epidemiologic data collection conformed to the WHO basic survey methods.[21] The accuracy of data recording in this study was further supplemented by the use of the WHO oral health assessment form 2013,[19] as a means to identify individual oral health status. The calibration of examiners prior to the survey and achievement of the WHO-recommended inter- and intraexaminer calibration for registration of dental caries were sufficiently beneficial in recording

caries, particularly in rural settings where daylight/pin-point focus handheld torches were used for visibility due to power shortages in schools.

This study provides a good overview of the general oral health status of the children. From this study, it can be concluded that dental caries is highly prevalent in 6-year-old and 12-year-old children in Pakistan, with similar trends in rural, peri-rural, or urban geographic locations and comparable statistics in both genders.

According to the WHO criteria for the classification of degrees of carious severity as interpreted from mean dft/DMFT scores,[23] the severity of dental caries in 6-year-old children was significantly high, while very low severity of caries was reported in 12-year-old children in this study. A national pathfinder survey conducted in 1991 reported DMFT in 12-year-old children, ranging from 1.9 to 1.1 in Punjab, in which the former represented the population with poor oral hygiene measures and the latter comprised individuals who employed oral hygiene provisions such as miswak/toothbrush.[24] In 2004, a DMFT of 1.59 was reported in 12-year-old children in Lahore.[25] A similar study, conducted in 2018, reported that 12-year-old children have a mean DMFT of 0.97 and 6-year-old children have a mean dft value 2.01.[26]

The mean dft of 9.85 in 6-year-old children and the high prevalence of caries, as reported in this study, corroborate with the findings of the studies from Lahore and Karachi. These findings can be attributed to the significantly high number of untreated, decayed primary teeth among individuals, which further attest to the unaddressed oral healthcare needs of this population. As already recognized by the WHO, childhood caries in areas with susceptible populations, such as those in developing countries, are highest in numbers despite being largely preventable.[27]

The epidemiologic data of this study comply with oral health surveys in many developing countries.[7,28-33] Past caries experience or presence of early childhood caries till age 6 is often reported as a predictor of future caries experiences in permanent teeth.[29] This may explain the slightly higher prevalence of caries experience in 12-year-old children in Rawalpindi District, as many of them were found to have predominantly filled teeth, which indicated previous and current caries experience.

A significant difference in the mean DMFT of 12-year-old children (i.e., 2.06 in urban locations and 4.2 in rural/ peri-rural geographical locations within the district) represents the burden of poor oral health as a consequence of disparities in oral health provisions within the district. Taking these findings, as well as findings from other studies that corroborate the authors' results, it is important to address these oral health statuses that reflect differently, on average, in children from rural and urban areas. As directed by the WHO, this calls for a national action to understand the key risk factors contributing to this inequality. Further efforts need to be made to foster the integration of oral health in primary healthcare systems of Pakistan and

facilitate, develop, and implement oral health registries and surveillance and monitoring mechanisms through strengthening cross-cultural collaborations, capacity building, and allowing for a skill mix to serve the population[27] and ensure optimal oral health once children reach adulthood.[30]

This study has certain limitations. The study did not take into account either the general sugar intake of the participants or their toothbrushing habits and other oral hygiene practices. No consideration was given to any details regarding the participants' access to fluoridated drinking water, their socioeconomic classes, and their preexisting level of dental hygiene awareness.

Conclusion

This study observed that dental caries was largely prevalent in 6-year-old and 12-year-old school-going children, particularly in 6-year-old children with untreated, decayed teeth. This calls for appropriate healthcare reforms and inclusion of dental health management in primary healthcare provisions to alleviate the populations' burden of this oral disease.

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