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Original Article

Effect Of Parental Education Level on Children Oral Health

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ABSTRACT

Background: Oral health is a major component of child well-being, yet children living in low-income urban communities remain disproportionately affected by preventable dental disease because of poor access to care, low health literacy, and inadequate preventive practices. Objective: To assess the association between parental education level and oral health outcomes among school-aged children living in an underserved urban slum of Lahore, Pakistan. Methods: A retrospective cross-sectional analysis was conducted using anonymized data from 196 children aged 5 to 15 years who participated in a community dental outreach program. Parental education was assessed through structured interviews, while children underwent standardized oral examination using DMFT and DEFT indices, along with oral hygiene assessment. Descriptive statistics, chi-square testing, one-way ANOVA, and correlation analysis were applied. Results: The mean age of participants was 9.8 ± 2.4 years, with equal representation of boys and girls. Mean DMFT and DEFT scores were 2.86 ± 1.47 and 3.12 ± 1.68, respectively. Higher parental education was significantly associated with lower DMFT and DEFT scores, with the lowest caries burden observed in the higher-education group. Parental schooling showed a moderate inverse correlation with DMFT score ($r = -0.42$, $p < 0.001$). Maternal education was also significantly associated with improved brushing frequency, fluoride toothpaste use, parental supervision, and annual dental visits. Conclusion: Higher parental, particularly maternal, educational attainment was associated with better oral hygiene practices and lower caries burden among children, underscoring the value of caregiver-focused oral health education in underserved populations. Keywords: parental education, oral health, DMFT, DEFT, dental caries, children, Lahore, Pakistan

INTRODUCTION

Oral health constitutes a fundamental component of overall child health, influencing not only physical well-being but also psychosocial development and quality of life. Dental caries remains one of the most prevalent chronic conditions among children globally, with a disproportionate burden observed in low- and middle-income countries (LMICs), where limited access to preventive services and inadequate health literacy contribute to poor oral health outcomes (1). In such settings, structural inequalities including poverty, lack of sanitation, and restricted access to dental care exacerbate the risk of untreated caries, gingival disease, and long-term oral morbidity (2,3). Children residing in urban slums are particularly vulnerable due to environmental constraints and reduced availability of organized healthcare services, resulting in persistently high disease prevalence and unmet treatment needs (4).

Among the various social determinants of health, parental education has emerged as a critical factor influencing child health outcomes, particularly through its effect on health literacy, caregiving practices, and health-seeking behavior (5). Educational attainment enables parents to better understand

disease prevention strategies, interpret health information, and adopt appropriate health behaviors, thereby directly shaping children's oral hygiene practices and dietary habits (6). Evidence from international studies indicates that higher parental education, especially maternal education, is associated with improved oral hygiene practices, reduced consumption of cariogenic foods, and increased utilization of preventive dental services among children (7,8). Conversely, children of parents with lower educational levels are more likely to experience poor oral hygiene, irregular dental visits, and higher incidence of dental caries (9,10).

The behavioral pathways linking parental education to oral health outcomes are multifactorial, involving daily supervision of oral hygiene practices, regulation of dietary patterns, and facilitation of access to dental care services. Studies have demonstrated that parental awareness significantly influences practices such as tooth brushing frequency, use of fluoridated toothpaste, and adherence to preventive dental visits, all of which are critical determinants of oral health status (11,12). In LMIC contexts, where formal healthcare systems are often under-resourced, these behavioral factors assume even greater importance, as parental guidance frequently serves as the primary mechanism for disease prevention (13,14).

Despite the growing body of global evidence, there remains a significant paucity of region-specific data examining the relationship between parental education and children's oral health outcomes in underserved populations within Pakistan. Existing studies have largely focused on broader socioeconomic determinants without adequately quantifying the association between educational attainment and standardized clinical indices such as Decayed, Missing, and Filled Teeth (DMFT) and Deciduous Teeth (DEFT) scores in slum settings (15). Furthermore, the differential impact of maternal versus paternal education on oral hygiene behaviors and clinical outcomes remains insufficiently explored in local contexts, limiting the development of targeted, culturally appropriate interventions.

Addressing this gap is essential for informing public health strategies aimed at reducing oral health disparities among vulnerable populations. Understanding how parental education influences both behavioral practices and clinical outcomes can provide a foundation for designing effective community-based educational programs and preventive interventions. Therefore, this study aims to evaluate the association between parental education level and oral health outcomes among school-aged children residing in an urban slum of Lahore, Pakistan, using standardized clinical indices and behavioral assessments. It is hypothesized that higher parental educational attainment, particularly maternal education, is associated with improved oral hygiene practices and lower DMFT/DEFT scores among children.

MATERIALS AND METHODS

A community-based cross-sectional analytical study was conducted to evaluate the association between parental educational attainment and oral health outcomes among school-aged children residing in a low-income urban slum area of Lahore, Pakistan. The study utilized retrospectively collected, anonymized data obtained during a structured dental outreach program carried out at a community-based educational facility serving underprivileged populations. The cross-sectional design was selected as an appropriate methodological approach to estimate the prevalence of oral health conditions and examine their association with sociodemographic and behavioral variables within a resource-constrained setting (16).

The study population comprised children aged 5 to 15 years who were present at the outreach site during the screening period and whose parents or guardians provided relevant demographic and educational information. This age range was selected to capture both deciduous and mixed dentition stages, allowing comprehensive assessment using standardized indices. Participants were recruited through a convenience sampling approach due to the logistical feasibility of accessing a concentrated population within the outreach setting. Eligibility criteria included children within the specified age

range, availability of complete parental education data, and participation in both questionnaire-based assessment and clinical oral examination. Children with conditions impairing accurate clinical assessment or incomplete parental data were excluded to maintain data integrity.

Data collection was conducted in two sequential phases. In the first phase, trained interviewers administered a structured questionnaire to parents or guardians to obtain sociodemographic information, including parental educational attainment, as well as behavioral data related to children's oral hygiene practices, dietary patterns, and prior dental care utilization. Parental education was categorized into ordinal levels (none, primary, secondary, and higher education) to facilitate analytical comparison. Behavioral variables included frequency of tooth brushing, use of fluoridated toothpaste, parental supervision during oral hygiene practices, frequency of sugary food consumption, and history of dental visits.

In the second phase, clinical oral examinations were performed by calibrated dental examiners using standardized procedures consistent with internationally recognized guidelines (17). Dental caries were assessed using the Decayed, Missing, and Filled Teeth (DMFT) index for permanent dentition and the Decayed, Extracted, and Filled Teeth (DEFT) index for deciduous dentition. Oral hygiene status was evaluated using validated indices, including the Simplified Oral Hygiene Index (OHI-S) and Gingival Index, ensuring objective assessment of plaque accumulation and gingival health. Examinations were conducted under natural light using sterilized dental instruments, and calibration sessions were conducted prior to data collection to ensure inter-examiner reliability and consistency in measurements.

The primary outcome variables were DMFT and DEFT scores, representing the burden of dental caries. Secondary outcomes included oral hygiene practices and indices reflecting behavioral and clinical oral health status. Additional variables such as body mass index, fluorosis, and malocclusion were recorded as descriptive findings and were not included in the primary analytical framework. Potential confounding variables, including age and gender, were accounted for during analysis to minimize bias in estimating associations between parental education and oral health outcomes.

The sample size was determined using a standard formula for estimating proportions in a population, assuming a 50% prevalence of dental caries due to lack of prior local estimates, with a 95% confidence level and a 7% margin of error, resulting in a minimum required sample of 196 participants. This sample size provided adequate statistical power to detect significant associations between parental education levels and oral health indices.

Data were entered and analyzed using IBM SPSS Statistics version 26. Descriptive statistics were computed to summarize demographic characteristics and oral health indices, with continuous variables presented as means and standard deviations and categorical variables as frequencies and percentages. Inferential statistical analyses included chi-square tests to assess associations between categorical variables, and one-way analysis of variance (ANOVA) to compare mean DMFT and DEFT scores across different levels of parental education. Pearson correlation analysis was performed to evaluate the strength and direction of relationships between parental education and oral health indices. Multivariable regression analysis was conducted to adjust for potential confounders, including age and gender, thereby improving the validity of observed associations. A p-value of less than 0.05 was considered statistically significant.

To address potential sources of bias, standardized data collection procedures and examiner calibration were implemented to minimize measurement variability. The use of structured questionnaires reduced interviewer bias, while exclusion of incomplete records minimized information bias. Although convenience sampling may limit generalizability, it was considered appropriate given the exploratory nature of the study in a hard-to-reach population.

Ethical considerations were strictly adhered to throughout the study. The use of anonymized, retrospectively collected data ensured participant confidentiality, and prior informed consent and child assent had been obtained during the original outreach program. The study complied with internationally accepted ethical standards for human research, including principles outlined in the Declaration of Helsinki (18). Data were securely stored and accessed only for research purposes, ensuring integrity and reproducibility of the study findings.

RESULTS

A total of 196 children were included in the analysis, comprising 98 boys and 98 girls, with a mean age of 9.8 ± 2.4 years. Overall oral health assessment showed a moderate burden of dental disease and oral hygiene impairment. The mean DMFT score was 2.86 ± 1.47, ranging from 0 to 6, while the mean DEFT score was 3.12 ± 1.68, ranging from 0 to 7. The mean OHI-S score was 1.89 ± 0.72, indicating overall moderate oral hygiene status, and the mean Gingival Index was 1.21 ± 0.53, consistent with mild-to-moderate gingival inflammation. Higher parental educational attainment was associated with lower caries scores across both dentitions, with statistically significant differences observed across education strata.

There was a graded decline in both DMFT and DEFT scores with increasing parental education. Children of parents with no formal education demonstrated the highest mean DMFT and DEFT values, at 3.87 ± 1.26 and 4.15 ± 1.72, respectively, whereas children of parents with higher education had the lowest values, at 1.78 ± 0.97 and 1.92 ± 1.15. The reported p-values showed statistically significant between-group differences for each education category comparison presented in the manuscript, with all values below 0.05. In addition, parental years of schooling showed a moderate inverse correlation with DMFT score ($r = -0.42$, $p < 0.001$), indicating that increasing educational exposure was associated with a measurable reduction in caries burden.

Oral hygiene behaviors also varied substantially according to maternal education level. Twice-daily tooth brushing increased from 22.2% among children of mothers with no education to 83.3% among those whose mothers had higher education. Use of fluoridated toothpaste rose from 29.6% to 87.5%, parental supervision during brushing increased from 41.0% to 79.1%, and annual dental visits increased from 11.1% to 62.5% across the same educational gradient. All behavioral associations were statistically significant, with p-values ranging from 0.001 to 0.017, supporting a strong relationship between maternal education and favorable preventive oral health practices.

Table 1. Demographic and Overall Oral Health Characteristics of the Study Population

Variable	Value
Total participants, n	196
Boys, n (%)	98 (50.0)
Girls, n (%)	98 (50.0)
Age, mean ± SD (years)	9.8 ± 2.4
DMFT, mean ± SD	2.86 ± 1.47
DMFT range	0–6
DEFT, mean ± SD	3.12 ± 1.68
DEFT range	0–7
OHI-S, mean ± SD	1.89 ± 0.72
OHI-S range	0.6–3.5
Gingival Index, mean ± SD	1.21 ± 0.53
Gingival Index range	0.4–2.3

Table 2. Oral Health Indices According to Parental Education Level

Parental Education Level	Mean DMFT ± SD	Mean DEFT ± SD	Reported p-value
None	3.87 ± 1.26	4.15 ± 1.72	0.001*
Primary	3.14 ± 1.38	3.39 ± 1.51	0.014*
Secondary	2.42 ± 1.22	2.61 ± 1.40	0.031*

Parental Education Level	Mean DMFT ± SD	Mean DEFT ± SD	Reported p-value
Higher	1.78 ± 0.97	1.92 ± 1.15	0.009*

*One-way ANOVA as reported in the source manuscript; $p < 0.05$ considered statistically significant. The manuscript does not provide group sample sizes, confidence intervals, or effect sizes for these comparisons.

Table 3. Correlation Between Parental Schooling and Dental Caries Burden

Variable Pair	Correlation Coefficient (r)	p-value
Years of parental schooling vs DMFT	-0.42	<0.001

Table 4. Oral Hygiene Practices According to Mother's Education Level

Practice	None (%)	Primary (%)	Secondary (%)	Higher (%)	p-value
Brushes twice daily	22.2	38.2	62.0	83.3	0.001*
Uses fluoride toothpaste	29.6	45.6	70.0	87.5	0.003*
Parental supervision during brushing	41.0	54.3	66.0	79.1	0.017*
Annual dental visit	11.1	19.1	34.0	62.5	0.002*

*Chi-square test as reported in the source manuscript; $p < 0.05$ considered statistically significant.

Table 1 shows that the study analyzed 196 children with an exactly balanced sex distribution, as boys and girls each accounted for 50.0% of the sample. The mean age was 9.8 years with a standard deviation of 2.4 years, indicating inclusion of both younger school-aged children and early adolescents. The mean DMFT score was 2.86, while the mean DEFT score was slightly higher at 3.12, suggesting that caries burden was present in both permanent and deciduous dentitions. Oral hygiene status was suboptimal overall, with a mean OHI-S of 1.89 and a mean Gingival Index of 1.21, reflecting moderate hygiene impairment and noticeable gingival involvement in the population.

Table 2 demonstrates a clear educational gradient in dental caries experience. Mean DMFT declined progressively from 3.87 in children whose parents had no formal education to 3.14 in the primary education group, 2.42 in the secondary education group, and 1.78 in the higher education group. This corresponds to an absolute reduction of 2.09 DMFT units between the lowest and highest education categories. A similar pattern was observed for DEFT, which decreased from 4.15 to 3.39, then to 2.61, and finally to 1.92, representing an absolute decline of 2.23 units across the educational gradient. All reported p-values were below 0.05, indicating statistically significant differences in oral health indices across parental education levels.

Table 3 further supports this association by showing a moderate inverse correlation between parental years of schooling and DMFT score ($r = -0.42$, $p < 0.001$). Numerically, this indicates that as parental education increased, the burden of dental caries in permanent dentition tended to decrease in a meaningful and statistically robust manner. The direction and magnitude of this correlation strengthen the interpretation that parental education is not only categorically associated with oral health outcomes, but also linearly related to reduced disease burden.

Table 4 highlights substantial differences in preventive oral hygiene behaviors according to maternal education level. Twice-daily brushing increased by 61.1 percentage points, from 22.2% in the no-education group to 83.3% in the higher-education group. Use of fluoridated toothpaste increased by 57.9 percentage points, from 29.6% to 87.5%. Supervision during brushing rose from 41.0% to 79.1%, a difference of 38.1 percentage points, while annual dental visits increased from 11.1% to 62.5%, a gain of 51.4 percentage points. All behavioral comparisons were statistically significant, with p-values ranging from 0.001 to 0.017, indicating that higher maternal education was consistently associated with better oral health practices and greater preventive care uptake.

A cross-table interpretation suggests that the behavioral improvements shown in Table 4 parallel the reduction in caries burden shown in Tables 2 and 3. The education category with the highest prevalence of twice-daily brushing, fluoride toothpaste use, and annual dental visits also had the lowest

DMFT and DEFT scores, whereas the group with the poorest preventive behavior profile had the highest caries burden. This pattern supports the interpretation that parental, particularly maternal, education may influence oral health partly through improved household oral hygiene practices and care-seeking behavior.

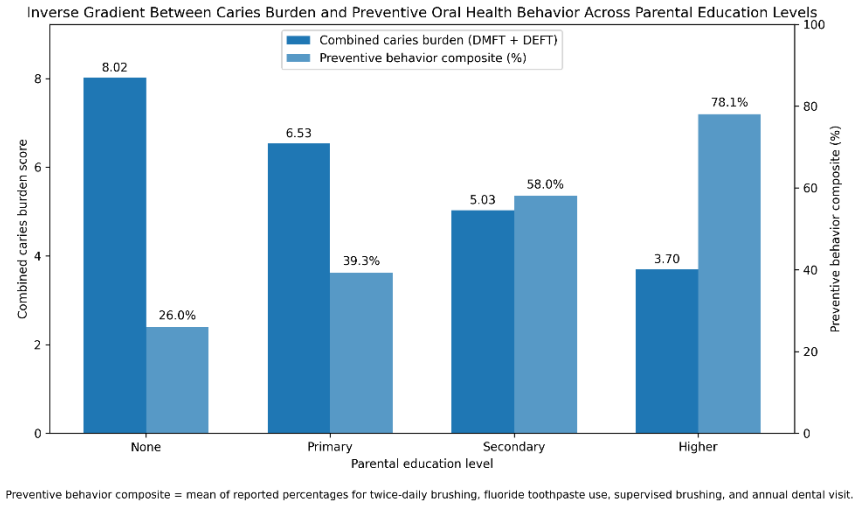

Figure 1 Prevalence behaviour across parental educational categories

Across the four parental education categories, the summed caries burden index (DMFT+DEFT) declined steadily from 8.02 in the no-education group to 6.53 in the primary group, 5.03 in the secondary group, and 3.70 in the higher-education group, representing an absolute reduction of 4.32 units and an approximate 53.9% decline from the lowest to the highest education stratum. In parallel, the derived preventive behavior composite increased from 26.0% to 39.3%, 58.0%, and 78.1%, showing a 52.1 percentage-point improvement across the same gradient. This inverse pattern indicates that children from more educated households not only had markedly lower cumulative caries experience, but also demonstrated substantially greater uptake of key preventive practices, supporting a clinically meaningful education-linked shift from disease burden toward oral health protection.

DISCUSSION

The present study demonstrated a clear and statistically significant association between parental educational attainment and oral health outcomes among children residing in an underserved urban community of Lahore. Children belonging to families with lower parental education had consistently higher DMFT and DEFT scores, whereas those from more educated households showed lower caries burden and better oral hygiene practices. This pattern suggests that educational attainment functions not merely as a sociodemographic descriptor but as an important determinant of household health behavior, preventive care orientation, and day-to-day supervision of children's oral hygiene. The observed inverse relationship between parental schooling and DMFT score, reflected by a moderate negative correlation coefficient, further strengthens the interpretation that increasing educational exposure is linked with lower disease burden in permanent dentition. These findings are consistent with prior international evidence showing that parental education improves health literacy, risk perception, and utilization of preventive oral health measures in children (19,20).

A particularly important finding of this study is the pronounced gradient across maternal education levels in relation to preventive oral health practices. The proportion of children brushing twice daily, using fluoridated toothpaste, receiving supervision during brushing, and attending annual dental visits increased substantially with each successive maternal education category. This supports the view that maternal education may have a stronger proximal effect on daily health behavior than paternal education, likely because mothers in many households remain more directly involved in child feeding, hygiene monitoring, and care-seeking decisions. Similar findings have been reported in large family-

based and school-based investigations, where maternal educational attainment was more strongly associated with children's oral health knowledge, brushing practices, and dental attendance than paternal schooling alone (21,22). In practical terms, the present results suggest that educational disparities operate behaviorally before they fully manifest clinically, meaning that poor oral health outcomes may emerge through preventable pathways such as inadequate brushing routines, lower fluoride exposure, and delayed dental consultation.

The magnitude of difference in both DMFT and DEFT across education categories is clinically meaningful. Children of parents with no formal education had the highest caries burden, while those in the higher-education group had the lowest scores in both dentitions. This decline across categories suggests a dose-response-like pattern, which is important because it indicates that the relationship is unlikely to be random or isolated to a single subgroup. Previous studies from Pakistan and comparable LMIC settings have also reported that children exposed to lower household educational and socioeconomic environments experience greater untreated caries, poorer hygiene, and lower access to preventive dental services (23,24). The current findings therefore extend local evidence by demonstrating this association using both behavioral indicators and standardized clinical indices in a slum-based population, which remains underrepresented in oral health literature despite carrying a substantial burden of preventable disease.

The public health relevance of these findings is considerable. In low-resource urban settings, oral disease prevention often depends less on formal dental infrastructure and more on the capacity of caregivers to implement basic health-promoting behaviors within the household. Where access to dentists, community screening, and fluoride-based prevention is limited, parental knowledge and supervision become critical mediators of child oral health. The strong differences seen in annual dental visits and fluoride toothpaste use across maternal education levels suggest that educational interventions could generate substantial benefit even before broader structural reforms are achieved. Community-based oral health education programs directed toward parents, especially mothers and caregivers in low-literacy environments, may therefore represent a realistic and scalable strategy for reducing oral health inequalities among school-aged children (25).

This study has several strengths. It was conducted in a marginalized urban population that is often overlooked in conventional dental epidemiology, thereby contributing context-specific evidence from a high-need setting. The use of standardized oral health indices, including DMFT, DEFT, OHI-S, and Gingival Index, improves the comparability and clinical relevance of the findings. In addition, the integration of clinical examination with behavioral data enabled the study to explore not only disease burden but also plausible pathways through which parental education may influence oral health outcomes. The balanced gender distribution and inclusion of children across a broad school-age range further strengthen the descriptive value of the dataset.

Several limitations should also be considered while interpreting these results. First, the cross-sectional design does not permit causal inference, and the observed associations cannot establish whether parental education directly causes lower caries burden or whether it operates through related socioeconomic and behavioral mechanisms. Second, convenience sampling may limit external validity, as the sample may not fully represent all children living in similar underserved settings. Third, some behavioral variables relied on parent- or guardian-reported information, which may be vulnerable to recall bias or social desirability bias. Fourth, although age and gender were recognized as potential confounders, the manuscript data do not provide a sufficiently detailed multivariable output to determine the independent strength of each association after full adjustment. These limitations do not negate the findings, but they do indicate that the results should be interpreted as strong associative evidence rather than definitive causal proof (26).

Future research should build on these findings using longitudinal or cohort-based designs to clarify temporal and causal pathways between parental education, oral hygiene behavior, and caries

progression. Further work should also examine whether structured educational interventions for caregivers can measurably improve brushing frequency, fluoride use, and preventive dental attendance in low-income communities. In addition, future studies may benefit from distinguishing more clearly between maternal and paternal educational effects, while also incorporating income, occupation, and household crowding to understand the broader social ecology of oral health inequalities. Such research would help refine community-level prevention strategies and support more targeted oral health policy planning in Pakistan and other LMIC settings.

CONCLUSION

This study found that higher parental educational attainment, particularly maternal education, was associated with lower DMFT and DEFT scores, better oral hygiene practices, greater use of fluoridated toothpaste, more supervision during brushing, and higher frequency of annual dental visits among children living in an underserved urban community of Lahore. These findings indicate that parental education is an important social determinant of child oral health and likely influences outcomes through improved health literacy, preventive practices, and care-seeking behavior. Although the cross-sectional design precludes causal interpretation, the observed educational gradient highlights the need for community-based oral health promotion programs that prioritize caregiver education, especially in low-income and low-literacy populations, as a practical strategy for reducing preventable oral disease in children.

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