

THE ASSOCIATION BETWEEN MATERNAL LITERACY AND CHILD ORAL HEALTH: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: To assess whether maternal education level predicts key child oral health behaviors and outcomes using logistic regression analysis.

Methodology: A cross-sectional study was conducted involving mothers of pre-school aged children across different schools in Karachi, Pakistan. Data was collected on following oral health indicators: knowledge about dental caries, brushing frequency, brushing supervision, dental visits in the past year, use of fluoride toothpaste and bedtime oral hygiene. Maternal hygiene was categorized into four levels and analyzed as an ordinal predictor. Chi-square was used to test associations and logistic regression analysis was used to evaluate predictive strength.

Results: Maternal education was significantly associated with six of seven oral health outcomes. Logistic regression analysis revealed that higher maternal education predicted higher odds of brushing supervision, dental visits, fluoride toothpaste use and bedtime oral hygiene. Brushing frequency showed a positive trend but was not statistically significant.

Conclusion: Maternal education and awareness are strong predictors of child oral health behaviors and habits. These findings indicate the need for public health interventions that incorporate maternal education and tailored oral health education to promote improvements in pediatric dental health.

Keywords: Child Oral Health, Dental Caries, Fluoride Toothpaste, Maternal Education, Oral Health, Toothbrushing Habits.

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INTRODUCTION

Oral health is a fundamental component of general health and well-being. In early childhood, particularly

among preschool children, oral hygiene practices are largely dependent on parental guidance and care¹. The health and nutritional status of mothers and their children are closely interlinked, with maternal behaviors and attitudes playing a pivotal role in shaping the child's oral health outcomes. Research indicates that maternal factors such as age, education and place of residence significantly influence child health indicators².

A strong understanding of oral health concepts among mothers fosters the development of positive health behaviors in children. Educated mothers are more likely to make informed decisions, manage household resources effectively and promote hygienic practices³. Given that children under six spend most of their time with primary care-givers – typically their mothers – when enrolled in early education settings, maternal knowledge and attitudes towards oral care are critical in establishing lifelong dental habits⁴.

Maternal literacy has been shown to enhance health awareness, nutritional choices, and environmental safety, all of which contribute to better oral health in

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children⁵. In developing countries, like Pakistan, maternal education is strongly associated with improved physical growth and cognitive development in children⁶. While paternal education also influences child health outcomes, its impact is relatively less pronounced compared to maternal education^{5,7}.

Numerous studies have demonstrated that higher levels of parental education correlate with improved dental self-care among children^{8,9}. Additional factors such as child gender, developmental stage, and time spent with caregivers further modulate oral hygiene practices. Notably, the benefits of maternal literacy – such as reduced disease prevalence, enhanced immunity, and better cognitive performance – are not equally replicated through paternal literacy alone¹⁰.

Over the past decade, evidence has consistently highlighted the role of maternal education in reducing infant and child mortality. In Pakistan, where the female literacy rate remains alarmingly low – estimated at around 48% nationally and significantly lower in rural regions – many mothers lack access to essential health information, including guidance on oral hygiene¹¹. This educational gap contributes to poor health literacy, limited awareness of preventive care, and delayed health-seeking behavior, all of which affect children's dental health.

Preschool-aged children are especially vulnerable to oral diseases such as dental caries and gingivitis, which are largely preventable through routine hygiene practices and timely dental visits. However, in Pakistan, oral health is often deprioritized due to limited public awareness, cultural misconceptions, and inadequate integration of dental education into primary health-care¹². Mothers with little or no formal education may not recognize the importance of brushing frequency, fluoride use, or dietary control in preventing dental decay¹¹. Moreover, socioeconomic constraints and gender norms further restrict women's ability to access health services or make autonomous decisions regarding their children's care⁸.

Given these challenges, there is a pressing need to explore the relationship between maternal health awareness and child dental outcomes in Pakistan. Understanding this association can inform the design of targeted interventions, such as community-based oral health education programs, maternal literacy initiatives, and school-based dental campaigns. These efforts are essential to bridge the knowledge gap, empower mothers and reduce the burden of oral disease among Pakistani children.

Therefore, this study aims to examine the association between maternal awareness of oral hygiene practices and the dental health of preschool-aged children in

Pakistan, with a focus on how maternal literacy influences health behaviors and outcomes.

METHODOLOGY

This cross-sectional study was conducted at Hamdard University Dental Hospital, Karachi Pakistan, to evaluate the association between maternal oral health awareness and the dental health of preschool-aged children. A total of 300 mothers of children aged up to six years were recruited. The sample size was calculated using OpenEpi v3 (www.openepi.com), ensuring sufficient statistical power for analysis. Ethical approval was obtained from Hamdard University Institutional Review Board (Ref No.: HCM&D/HUDH/1035-22).

Study Population and Sampling

Participants were selected through a convenience sampling technique from various schools located across multiple districts of Karachi. These schools represented a mix of private and government institutions, capturing a diverse socioeconomic spectrum. Inclusion criteria comprised of mothers under the age of 40 years whose children were healthy, active and approximately six years old. Mothers above the age of 40, children with neurological disorders or congenital syndromes were excluded to reduce confounding variables. The age criteria for mothers were set to ensure a homogenous sample of caregivers with active parenting roles and to minimize the generational differences.

Study Design and Data Collection

A structured questionnaire was used to collect data, adapted from a previously validated questionnaire. (13) Modifications were made to align the tool with the local context and study objectives. The questionnaire was administered in both English and Urdu to accommodate varying literacy levels and ensure comprehension. Distribution was facilitated through school administrations, using both Google Forms and printed versions based on participant preference and technological access.

Prior to data collection, formal approval was obtained from the respective school authorities. Participants were informed about the study purpose and written informed consent was obtained.

Questionnaire Structure and Reliability

The questionnaire included both demographic and behavioral items. Demographic variables included maternal age, education level (categorized as high school, graduate and postgraduate), and number of children. Mothers were stratified into four groups based on educational qualifications for comparative analysis.

Behavioral items assessed maternal oral health knowl-

edge and practices, including:

1. Brushing frequency and technique
2. Toothpaste selection and fluoride awareness
3. Familiarity with the term “dental caries”
4. Dental visit frequency and purpose

Child-specific oral health indicators included:

1. Age at initiation of brushing
2. Brushing supervision and methods
3. Dietary habits and sugar intake
4. Sleep routines and oral hygiene before bedtime

The questionnaire was reviewed by PI and two other experts in public health and community dentistry to ensure content validity. To ensure internal consistency and reliability of the questionnaire, Cronbach’s alpha was calculated and yielded a value of 0.80, indicating acceptable reliability across the instrument’s key domains. A pilot test was conducted with 10 participants to ensure relevance and usability before conducting the study.

Statistical Analysis

Data was entered and analysed using IBM SPSS v26. Descriptive statistics were used to summarize demographic characteristics and oral health practices. The chi-square test was applied to assess associations between maternal education level and child oral health outcomes. Logistic regression analysis was used to predict the likelihood of dental outcomes based on maternal education. A p-value of <0.05 was considered statistically significant.

RESULTS

Out of 300 distributed questionnaires, 278 were returned, yielding a high response rate of 89%. The data analysis revealed a strong association between maternal education and various aspects of child oral health, including awareness of dental caries, initiation of tooth brushing and selection of fluoride toothpaste.

Table 1 shows the results of Chi square analysis showing the association of maternal education with child’s oral health and hygiene practices. The results showed that understanding of the term “dental caries” increased sharply with education, from 17.6% in the lowest group to over 83% in the highest (p-value <0.001). Brushing initiation before age 2 is most common among mothers with graduation and post-graduation education (p-value <0.001). Fluoride selection is highest among graduates and postgraduates (61.3% and 66.1% respectively), indicating strong awareness of preventive dental care (p-value= 0.02). Twice daily brushing showed an

increased trend with higher education, however, the association was not statistically significant (p-value= 0.074). Mothers with higher education are significantly more likely to supervise their child’s brushing (p-value= 0.015). Routine dental visits are more common among educated mothers (p-value= 0.009). Bedtime oral hygiene was significantly implemented by highly educated mothers (p-value <0.001).

Table 2 shows the results of logistic regression analysis which was done to determine whether maternal education level predicts key child oral health outcomes. Maternal education was numerically encoded as an ordinal variable (0 = middle school, 1 = Completed High School, 2 = Graduation, 3 = Post Graduation), and separate binary logistic regression models were applied for each outcome. The results revealed that higher maternal education significantly reduced the likelihood of dental caries in children as they had more understanding of the term (OR = 0.61, p = 0.003, 95% CI: [0.44, 0.85]), indicating a protective effect. It also increased the odds of consistent brushing supervision (OR = 1.50, p = 0.015), dental visits in the past year (OR = 1.54, p = 0.009), fluoride toothpaste use (OR = 1.61, p = 0.004), and bedtime oral hygiene (OR = 1.83, p < 0.001), all statistically significant. Although brushing frequency showed a positive trend (OR = 1.34), it did not reach statistical significance (p = 0.074). These findings underscore the critical role of maternal education in shaping preventive oral health behaviours and outcomes in children, with the strongest effects observed in bedtime hygiene and fluoride use.

DISCUSSION

The current study provides evidence for the significant influence of maternal education on child oral health outcomes, reinforcing its role as a critical determinant of pediatric health behavior. Mothers with higher education demonstrated greater awareness of oral hygiene principles, more consistent preventive practices and stronger health-seeking behaviours. These findings are consistent with other studies that position maternal literacy as a foundational element in shaping a child’s habit¹⁴.

The study demonstrated that mothers with graduation or higher education were more aware of the term dental caries, as compared to those with education limited to high school. This reinforces the fact that the mothers who are more aware will work on the prevention of the disease as well. For instance, Tenebaum et al., reported that mothers with secondary education were significantly more knowledgeable about caries prevention and more likely to facilitate dental visits for their children¹⁵. This finding is consistent with the studies conducted in Pakistan that children with educated mothers had significantly lower caries prevalence and better oral

TABLE 1: ASSOCIATION OF MATERNAL EDUCATION LEVEL WITH CHILDREN'S ORAL HEALTH BEHAVIOUR

Maternal Education Level	Middle School (n=17)	Completed High School (n=35)	Graduation (n=111)	Postgraduation (n=59)	p-value
Variable					
Understanding of dental caries	17.60%	42.90%	58.80%	83.30%	<0.001
Age of Brushing Initiation					
Before 2 yrs	17.60%	12.00%	87.40%	94.90%	<0.001
At 2 yrs	11.80%	17.10%	7.20%	3.40%	
After 2 yrs	70.60%	48.60%	5.40%	1.70%	
Brushing Frequency					
Once daily	47.10%	40%	38.70%	44.10%	0.074
Twice Daily	17.60%	34.30%	42.30%	47.50%	
Occasionally	35.30%	25.70%	19%	8.40%	
Brushing Supervision					
Always	29.40%	40%	51.40%	57.60%	0.015
Sometimes	41.20%	37.10%	32.40%	33.90%	
Never	29.40%	23%	16.20%	8.50%	
Dental Visit in the past year	23.50%	34.30%	42.30%	55.90%	0.009
Use of Fluoride Toothpaste (child)	17.60%	25.70%	61.30%	66.10%	0.02
Brushing before bedtime	29.40%	40%	61.30%	71.20%	<0.001

TABLE 2: LOGISTIC REGRESSION ANALYSIS OF MATERNAL EDUCATION PREDICTING CHILD'S ORAL HEALTH OUTCOMES

Outcome variable	Odds Ratio	CI (95%)	p-value
Understanding of dental caries	0.61	0.44-0.85	0.003
Age of brushing initiation	2.94	2.01-4.29	<0.001
Brushing frequency	1.34	0.97-1.85	0.074
Brushing supervision	1.5	1.08-2.09	0.015
Dental visit in the past year	1.54	1.11-2.14	0.009
Use of Fluoride toothpaste	1.61	1.16-2.23	0.004
Brushing before bedtime	1.83	1.35-2.48	<0.001

hygiene scores^{11,16}.

Brushing frequency, specifically twice-daily brushing, showed a positive trend with increasing maternal education (OR= 1.34), although it was not statistically significant. Nonetheless, the pattern aligns with findings from Salama et al., where mothers with higher education were more likely to encourage regular brushing habits¹⁷. Another study reported that only 42% of the mothers supervised brushing daily, with lower rates among those with limited education¹⁸. While this study did not find a statistically significant predictive relationship, the observed trend suggests that maternal

education influences brushing frequency, potentially mediated by other factors such as household routines and child autonomy.

Brushing supervision was significantly associated with maternal education (OR= 1.50), indicating that educated mothers were more likely to consistently oversee their child's oral hygiene practices. This result is supported by findings from Moin et al,¹¹ where maternal education was linked to structured hygiene routines and active parental involvement. Other studies have shown that mothers with limited education often lack the awareness or time to supervise brushing, leading

to inconsistent practices^{6,19,20}. The current study adds to the literature by quantifying the predictive strength of maternal education in promoting supervised brushing.

The timing of brushing initiation emerged as another domain strongly influenced by maternal education. In this study, 87.4% of children of graduate mothers and 95.6% of children of postgraduates began brushing before the age of two. The higher rates in this study can be due to urban sampling, increased access to health information, or the impact of or localized awareness campaigns. These findings are in line with the research conducted by Moin et al. and Adil et al., which demonstrated that maternal education positively influences structures hygiene routines and dietary practices in children^{11,21}.

The use of fluoride toothpaste was strongly predicted by maternal education (OR = 1.61), with educated mothers demonstrating a greater awareness of its preventive benefits. This result aligns the findings conducted by Sami et al., who found that maternal knowledge was a key determinant of fluoride use²². However, another study in Pakistan reported that only a few mothers were aware of fluoride's role in caries prevention, highlighting a gap in public health messaging¹². The findings of the current study are in accordance with the data from other studies that fluoride use is not related awareness only but also to educational level, reinforcing the need for targeted educational interventions²¹.

Bedtime oral hygiene emerged as the most strongly predicted behaviour (OR=1.83), with children of educated mothers significantly more likely to brush before sleep. This finding is consistent with other studies which emphasized the role of maternal education in establishing structured hygiene routines^{1,23}. Another study in Pakistan noted that bedtime brushing was often neglected, particularly in households with lower maternal literacy, the findings are in accordance with the current study⁵.

The current study offers a comprehensive understanding of how maternal literacy influences oral hygiene practices and outcomes. The use of logistic regression analysis adds statistical rigor, allowing for the quantification of predictive relationships. However, the study is not without limitations. The study design is cross-sectional, which restricts the causal inference. Moreover, the sample consists of the urban population, limiting the generalizability to rural communities with different access and awareness levels. The absence of control for confounding variables such as household income, paternal education and access to dental care may also influence the observed associations. Despite these limitations, the study offers evidence that maternal education is both statistically associated and predictive of key child oral health behaviors.

CONCLUSION

The study's findings underscore the critical role of maternal literacy in shaping early oral hygiene habits and preventive care. This further indicates that public health awareness strategies should be developed to reduce the burden of early childhood caries and oral diseases.

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| 5. Khalil Ahmed: | Data collection, editing |
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QUESTIONNAIRE FOR MOTHERS

Age Of Mother:	
1. 15-20 2. 21-25 3. 26-30 4. 31-40	
Number Of Children:	
Number Of Children Under 5 Years Old:	
1. Who is the main care taker for the child?	2. What is the education level of mother?
1. Mother 2. Others Specify.....	1. Didn't go to school 2. Up to high school 3. Completed high school 4. Completed graduation 5. Post Graduation
3. What is/was the pattern of feeding the child?	4. Does the child sleep with bottle?
1. Breast fed only 2. Mixed breast fed and bottle fed 3. Bottle fed only 4. Don't know	1. Yes 2. No 3. Don't know
5. What method do you use for brushing?	6. Does the child have a habit of having milk at night? *
1. Tooth Brush 2. Finger 3. Miswak	1. Yes 2. No 3. Occasionally
6(a). If yes, which form of milk is given to the child?	7. Who cleans the teeth of the child?
1. Plain 2. With sugar 3. With honey 4. If others, specify	1. Child himself 2. Mother 3. Other
8. What are the measures used for cleaning the teeth of the child?	9. At which age brushing was started?
1. Finger 2. Toothbrush alone 3. Toothbrush with toothpaste 4. Others, specify	1. Less than 1 year 2. 1.5 year 3. 2 year 4. 3 year 5. 4 year 6. Don't know
10. Does the child have the habit of having snacks between meal? *	10(a). * If yes, what is the frequency of having snacks per day?
1. Yes 2. No	1. Once 2. Twice 3. Thrice 4. On demand
11. How many times do you brush your teeth?	12. You buy tooth paste because of which reason?
1. Zero 2. Once a day 3. Twice a day	1. Flavor 2. Price 3. Fluoride 4. Other
13. Your last visit to a dentist	14. Do you have any idea of what carries is?
1. This week 2. This month 3. Last 6 months 4. Last Year or more	1. Yes 2. No
15. Parents are working?	
1. Mother / Father / both	