

Oral Health Literacy and Its Impact on DMFT Index Among Medical Students: A Cross-Sectional Study

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Abstract

Background: Oral health literacy (OHL) is essential in empowering individuals to make knowledgeable decisions about their oral health. Poor oral health literacy (limited OHL) is linked with poor oral health behaviors and negative health outcomes. Determinants of the oral health status are socioeconomic status, education, and, most importantly, OHL. Medical students had been selected primarily because they would become future medical professionals, and proficient oral hygiene knowledge is crucial for successful patient education, preventive care, and general welfare promotion.

Objective: This research sought to investigate the influence of oral health literacy on the dental caries experience by investigating Decayed, Missing, and Filled Teeth (DMFT) index among university students and assess how much Oral Health Literacy affects the outcome of dental health.

Material and Methods: A quantitative cross-sectional study was carried out among 97 King Edward Medical University students above 18 years of age. Data were gathered through a self-report questionnaire and clinical oral assessment, during which the DMFT index was evaluated. The validated Oral Health Literacy Adult Questionnaire (OHL-AQ) was used for this purpose.

Results: Findings illustrated a substantial correlation between OHL and DMFT values. Poor OHL students showed a greater mean DMFT value than those with good OHL, indicating worse oral health. The study included 97 university students (26.8% males, 73.2% females), of whom 64.9% had inadequate oral health literacy (OHL), with a mean OHL score of 9.57 ± 3.89 and an approximately normal distribution. Most participants (81.4%) had no missing teeth; however, inadequate OHL was significantly associated with a higher number of missing teeth ($p < 0.05$). Participants with inadequate OHL had significantly higher DMFT scores than those with adequate OHL (1.16 ± 1.38 vs. 0.59 ± 1.02 ; $t = -2.115$, $p = 0.037$), with a moderate effect size (Cohen's $d = 0.47$), indicating poorer dental health outcomes with lower OHL.

Conclusion: Oral health literacy has a quantifiable impact on oral health, as indicated by the DMFT index. Fortifying OHL through education, ensuring proper oral hygiene techniques, and prevention is critical for minimizing the dental disease burden and enhancing overall oral health outcomes.

Keywords: OHL, DMFT, Oral health

Introduction

Oral health literacy (OHL) is the capacity of individuals to access, process, and understand critical health information and services necessary to make proper decisions about their oral health¹. There is a relationship between greater levels of OHL, patients' communication with healthcare providers, medication and appointment management, and more desirable health outcomes. Health literacy has also been recognized as a determinant of an individual's capacity to maintain wellness, recover from illness, and enhance overall quality of life. Conversely, limited OHL can contribute to poor oral health outcomes and negative psychosocial effects, including reduced self-esteem, anxiety, and stress stemming from visible dental problems and inadequate understanding of oral care. These consequences may lead to social withdrawal, discomfort, and further deterioration in mental well-being.^{1,2} Thus, the role of oral health in overall health and quality of life cannot be underestimated.

Disparities in oral health outcomes are strongly shaped by socioeconomic, cultural, and educational factors.³ In addition, lifestyle behaviours—such as unhealthy dietary patterns, inadequate oral hygiene practices, insufficient sanitation,

limited exposure to fluorides, and tobacco or alcohol use—further exacerbate oral health problems. Poor oral health can substantially diminish an individual's self-confidence, societal functioning, and general quality of life.⁴

The Decayed, Missing, and Filled Teeth (DMFT) index, first introduced by Henry T. Klein in 1938, was developed to assess the prevalence of coronal caries. It remains one of the most widely accepted and extensively utilized indices in oral epidemiology. For more than seven decades, the DMFT index has served as the primary measure for evaluating the occurrence and severity of dental caries worldwide². By recording the number of decayed, restored, and missing teeth due to caries, the DMFT index provides a simple, reliable, and rapid tool for monitoring population-level oral health and informing public health policies and interventions.

Previous studies, including those by Haerian Ardakani et al., have demonstrated that OHL exerts a significant influence on DMFT scores.^{5,6} Understanding the interplay between OHL and DMFT is therefore critical for guiding oral health promotion strategies and reducing the burden of dental disease. While previous studies have explored associations between oral health literacy, behaviors, and outcomes, there is limited evidence among medical students in Pakistan, highlighting the need for context-specific research to better understand these relationships. These findings highlight several unresolved gaps, including the need for validated measures of oral health literacy, longitudinal assessment of how knowledge and behaviors evolve during training, and more rigorous evaluation of educational and behavioral interventions.

Against this background, the current study was designed to assess the impact of oral health literacy levels on the DMFT index among undergraduate students at King Edward Medical University. Against this background, the

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current study was designed to assess the impact of oral health literacy levels on the DMFT index among undergraduate students at King Edward Medical University.

Material and Methods

For this cross sectional study, approval was obtained from Institutional Review Board (IRB) of King Edward Medical University (KEMU) VIA Ref No. 123/RC/KEMU. An information sheet and informed consent were provided to all participants, and the anonymity and confidentiality of the expert respondents were strictly maintained throughout all phases of the research. The duration of this study was 3 months. All responses were recorded using unique codes with no link to individual identities. Data were stored in password-protected files accessible only to the research team. Findings are reported in aggregate form to prevent identification of any participant.

For this study Purposive Convenience sampling (A non-probability sampling approach combining purposive and convenience sampling was used, where participants meeting the inclusion criteria were recruited based on availability and willingness to participate).

A total sample size of 97 students was determined, applying a 95% confidence level and 10% absolute precision, with the expected prevalence of inadequate oral health literacy (OHL) set at 50.2%.

Inclusion Criteria:

1. Students who have given full consent were included.
2. Both genders were included.
3. All students above 18 years of age were included.

Exclusion Criteria:

1. Students with conditions that could impair their ability to understand or respond to the questionnaire
2. Students undergoing orthodontic treatment

Data were collected using a previously validated, self-administered questionnaire, which has demonstrated acceptable reliability and validity in similar populations (Annexure-1). And subsequently, a clinical oral examination was performed. The DMFT score was measured as per the recommended criteria by WHO, where dental caries was defined when a lesion in a pit or fissure or on a smooth surface tooth had a definite cavity, undermined enamel, or a detectably softened floor or wall. It also encompasses missing teeth due to caries and filled teeth. For this research, Silness-Löe plaque index was measured by the recording of soft debris and mineralized deposits on all four surfaces (buccal, lingual, mesial, and distal) of six index teeth: Maxillary right first molar, maxillary lateral incisor, maxillary left second premolar, mandibular left lateral incisor, mandibular right central incisor, and mandibular right first premolar. The plaque index (Silness-Löe) was included to provide an objective measure of current oral hygiene status, which complements the DMFT index that reflects cumulative dental caries experience. Assessing plaque levels allowed us to better understand the relationship between oral health literacy and actual oral hygiene practices. A 0 (none) to 3 (soft matter abundance) score range was assigned for every tooth. "Oral Health Literacy-Adults Questionnaire" (OHL-AQ), was given to students. The appropriate responses were marked 1, and the incorrect ones or left blank, 0. The questionnaire score could range from 0 to 17. For analysis, we recoded the OHL-AQ scores on two levels: inadequate, 0–11 (merging the "inadequate" and "marginal" categories); and adequate, 12–17⁴.

Data Collection Instruments : The following instruments were employed for data collection in this study:

1. Oral Health Literacy Assessment Tools

- *Oral Health Literacy Instrument (OHLI)*
- *Oral Health Literacy-Adults Questionnaire (OHL-AQ).*

2. Clinical Examination Tools

Standard dental instruments, including a dental probe and mouth mirror, were used for intraoral examination and recording of the DMFT index. All data were analyzed using SPSS (Statistical Package for the Social Sciences), version 25.0. Categorical variables were summarized as frequencies and percentages. An independent samples *t*-test was performed to examine the relationship between Oral Health Literacy (OHL) and Decayed, Missing, and Filled Teeth (DMFT) scores.

Results

The study included university students ($n = 97$), with 26 (26.80%) males and 71 (73.20%) female participants. Most participants (58.8%) had parents with a Secondary Education level. 69.1% participants only had one employed parent. (Table 1)

Table. 1- Demographic Characteristics of Participants

Characteristic	Frequency	Percentage
Gender		
Male	26	26.8%
Female	71	73.2%
Parent' Education		
Primary	9	9.3%
Secondary	57	58.8%
Higher	31	32%
Socioeconomic Status		
Low Income	1	1%
Medium Income	88	90.7%
High Income	8	8.3%
Parent's Job		
Both Unemployed	14	14.4%
One Employed	67	69.1%
Both Employed	16	16.5%

Total score for OHL questionnaire is from 0 to 17. The total score for the OHL questionnaire ranges from 0 to 17. For analytical purposes, OHL-AQ scores were dichotomized into two levels: inadequate (0–11) and adequate (12–17), consistent with approaches used in previous studies. Oral health literacy scores indicated that 34 (35.1%) participants had adequate OHL, while 63 (64.9%) were classified as inadequate. The histogram illustrates the distribution of OHL scores among the study participants ($N = 97$). The mean OHL score was 9.57 ($SD = 3.886$), indicating that the majority of participants fell within the inadequate category. The majority of scores clustered between 6 and 14, with the peak frequency observed around the mean, while only a few participants were found at the lower (0–2) or higher (15–20) ends of the scale. The overlaid bell-shaped curve demonstrates that the data approximates a normal distribution, supporting the appropriateness of using parametric statistical tests such as the *t*-test for further analysis. Overall, this distribution suggests that most participants exhibited a moderate level of oral health literacy, with relatively few showing extreme low or high values. (*Fig 1*)

The majority of participants (81.4%) had no missing teeth, 11.3% had one missing tooth, 6.2% had two missing teeth, and only 1.0% had three missing teeth. Overall, most participants retained their natural dentition, with relatively few reporting multiple missing teeth. This distribution also showed that individuals with inadequate Oral Health Literacy (OHL) tended to present with a

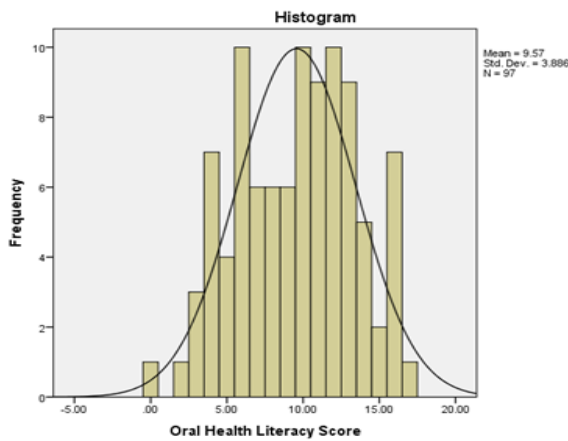


Figure 1: Distribution of OHL scores in the study sample (n = 97).

Table 2- Frequency of missing teeth among participants

Missing teeth (MT)				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid .00	79	81.4	81.4	81.4
1.00	11	11.3	11.3	92.8
2.00	6	6.2	6.2	99.0
3.00	1	1.0	1.0	100.0
Total	97	100.0	100.0	

greater number of missing teeth compared to those with adequate OHL, with the difference reaching statistical significance ($p < 0.05$). Overall, most participants retained their natural dentition, with relatively few reporting multiple missing teeth. (Table 2). The mean number of filled teeth (FT) was 0.34 ± 0.79 in the study population. Participants with inadequate OHL had a mean FT of 0.35 ± 0.83 , while those with adequate OHL had a mean of 0.32 ± 0.73 . This difference was not statistically significant ($t = 0.158$, $p = 0.875$), indicating that oral health literacy was not associated with restorative dental treatment (filled teeth).

Table 3a, & 3b showed that participants with inadequate Oral Health Literacy (OHL) had higher DMFT scores compared to those with adequate OHL. On average, the adequate OHL group had 0.59 affected teeth, while the inadequate OHL group had 1.16 affected teeth.

Levene's test indicated that the variability between the two groups was unequal ($p = 0.010$); therefore, the adjusted t -test results were considered. The independent samples t -test demonstrated a statistically significant difference between the groups ($t = -2.115$, $p = 0.037$), with a mean difference of -0.57. This means that participants with adequate OHL had, on average, about half a tooth fewer affected by decay, missing, or fillings compared to those with inadequate OHL. Levene's Test for Equality of Variances was significant ($F = 6.868$, $p = 0.010$), indicating that the assumption of equal variances was not met.

Table 3a. Levene's Test for Equality of Variances

Note: $p < 0.05 = *$, $p < 0.01 = **$, $p < 0.001 = ***$. A significant Levene's test ($p = 0.010$) indicates heterogeneity of variances; therefore, the "equal variances not assumed" line of the t -test was used.

Variable	Frequency	Significance
DMFT Index	6.868	0.010

Therefore, results were interpreted using the "equal variances not assumed" output.

Table 3b. Independent Samples t-test for Equality of Means

*Note: $t(85.98) = -2.115$, $p = 0.037$, indicating a statistically significant difference in DMFT scores between participants with adequate vs. inadequate OHL. Individuals with inadequate OHL had significantly higher DMFT scores. ($p < 0.05$)

OHL Group	Mean	SD	t	df	Sig. (2-tailed)
Adequate OHL	0.5882	1.0185	-2.115	95	0.037
Inadequate OHL	1.1587	1.3820	-2.313	85	.023
OHL Group	Mean Difference	Std. Error Difference	95% CI (Lower-Upper)	Cohen's d	
Adequate OHL	-0.5705	.2698	-1.10601	-.03498	
Inadequate OHL	-0.5705	.24663	-1.06079	-0.08020	

The independent samples t -test showed a statistically significant difference in DMFT index between participants with adequate and inadequate Oral Health Literacy (OHL) ($t = -2.115$, $df = 95$, $p = 0.037$). On average, individuals with inadequate OHL had a higher DMFT score ($M = 1.16$, $SD = 1.38$) compared to those with adequate OHL ($M = 0.59$, $SD = 1.02$). The mean difference of -0.57 was statistically significant, with a 95% confidence interval ranging from -1.11 to -0.04. The 95% confidence interval (-1.06, -0.03) further supports this finding, confirming that the difference was unlikely to be due to chance.

Overall, the results suggest that higher oral health literacy is associated with better dental health outcomes.

The overall mean DMFT score was 0.96 ± 1.29 , indicating a relatively low caries burden in the study population. However, participants with inadequate OHL had a higher mean DMFT (1.16 ± 1.38) compared to those with adequate OHL (0.59 ± 1.02), and this difference was statistically significant ($p = 0.037$), suggesting that lower oral health literacy is associated with poorer dental health outcomes.

The effect size (Cohen's $d = -0.471$) suggests a moderate practical impact, indicating that inadequate OHL is moderately associated with poorer oral health outcomes (higher DMFT scores). These findings highlight that beyond statistical significance ($p < 0.05$), the difference is meaningful in real-world terms, reinforcing the role of oral health literacy in maintaining dental health.

Discussion

The decayed, filled, and missing teeth (DMFT) index is still the most common measure applied in oral epidemiology for the evaluation of dental caries prevalence and the treatment requirements in populations². As a sensitive measure, the DMFT index is used to establish and follow up the oral status at the population level. Improving oral health literacy (OHL) was found to be a key factor in decreasing the rate of missing teeth, as identified in a cross-sectional study of Thai elderly by Sermsuti-Anuwat N.⁵ In the said study, patients with sufficient oral health knowledge were more inclined to receive timely dental procedures, including restorative procedures, while pa-

tients with low OHL tended to postpone treatment, thus having late diagnoses and extensive tooth structure loss.⁶ Socioeconomic status (SES) also becomes a significant predictor of DMFT scores¹⁰. People from lower SES groups often receive less access to oral health information and preventive services. Cost barriers can also restrict the affordability of necessary dental products like toothbrushes, dental floss, and mouthwash and decrease the frequency of regular dental visits. As a result, untreated caries in these individuals tends to advance to tooth loss, resulting in more missing teeth than filled teeth.¹¹⁻¹³ It also noted gender variations, with girls having greater OHL levels than boys, a finding that is supported by earlier studies.¹⁰ All these factors, combined with socioeconomic status, parental education, and gender, interact with OHL and have a direct effect on DMFT outcomes. More often than not, participants who had greater OHL would admit to recognizing the significance of oral health and preventive dental care, practice habits like toothbrushing, flossing, and mouthwash use, and thus had lower DMFT scores, according to Navabi N et al.⁴ On the other hand, individuals with poor OHL would tend to neglect preventive care and have much higher DMFT values.^{4,5}

Based on these results, the introduction of focused oral health awareness programs is highly suggested. Preventive oral hygiene habits and frequent dental checkup visits should be prioritized by public health interventions as ma-

for approaches to minimizing caries occurrence.^{14,15} School and college-based programs can promote early initiation of healthy practices, and special efforts in rural regions such as free dental checkups may eliminate disparities in care access. Strengthening the value of critical behaviors, like nocturnal brushing, must be a core focus of these educational activities, as these interventions can drastically limit the burden of caries among populations.¹⁴

Conclusion

Oral Health Literacy (OHL) plays an important role in the DMFT index. It is possible to play a crucial role in preventing and controlling dental diseases by increasing OHL and by adopting good oral hygiene habits, healthy diets, and seeking timely professional dental care. The results of this research provide valuable insights for developing targeted training courses for Pakistan's youth, ultimately leading to improved overall health, with a special emphasis on oral health. In addition, the data collected can serve as a basis for developing overall policies through coordination among government authorities, researchers, and the healthcare community to raise awareness and improve oral healthcare at the community level.

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Author Contributions

1. **Sadia Awais:** Conceptualization, study design, data collection, analysis, manuscript writing, and critical review.
2. **Rashid Javaid:** Conceptualization, funding support, and data interpretation.
3. **Sadia Shakeel:** Study design, supervision, and critical review.
4. **Talal Ahmad:** Supervision, funding support, and manuscript writing.
5. **Sonia Bibi:** Materials support, data collection, and data interpretation.
6. **Ansa Azeem:** Materials support, data collection, and literature review.