



ORIGINAL ARTICLE

Comparison between various oral health literacy scales among university students in Jaipur, India

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ABSTRACT

Background: Oral health literacy (OHL) is a multidimensional concept that encompasses reading, writing, speaking, listening, proper decision-making skills, assessment of OHL level, and comparison between scales. Numerous tools are available to measure OHL using a range of indicators.

Aim: The purpose of this study is to compare three OHL scales, namely, Rapid Estimate of Adult Literacy in Medicine and Dentistry-20 (REALMD-20), OHL Adults Questionnaire (OHL-AQ), and Health Literacy in Dentistry (HeLD), among university students in Jaipur, India.

Methods: A comparative study was conducted among 180 university students from non-medical courses. Students' literacy was measured using REALMD-20, OHL-AQ, and HeLD. Independent sample *t*-test, one-way ANOVA, Kruskal–Wallis test, and Pearson's correlation test were used for statistical analysis.

Results: A weak positive correlation coefficient was obtained between REALMD-20, OHL-AQ, and HeLD. The mean REALMD-20 scores of Groups 1, 2, and 3 were 16.3, 14.98, and 15.8, respectively. For OHL-AQ, the mean scores obtained for Groups 1, 2, and 3 were 6.77, 7.50, and 6.58, respectively. The mean HeLD scores in Groups 1, 2, and 3 were 104.23, 102.70, and 100.4, respectively. However, the differences between these groups on all three tested scales were not statistically significant.

Conclusion: In the present study, a weak positive correlation was observed between REALMD-20, OHL-AQ, and HeLD, thereby revealing potential shortcomings in each of these tools.

Relevance for Patients: Encouraging patients to articulate their comprehension of their conditions and instructions enables health-care providers to identify gaps and enhance OHL, leading to effective prevention of oral diseases.

1. Introduction

Oral health is a fundamental component of overall vitality and well-being. Regrettably, dental caries and gingivitis often affect students at an early age, with potential long-term consequences if these oral conditions are neglected [1]. The 20th century witnessed a distinct emphasis on the global importance of health literacy [2], as underscored in a recent report by the World Health Organization (WHO), which highlights the pivotal role of health literacy as a primary determinant of health-care outcomes. According to WHO, health literacy encompasses socio-cognitive skills influencing an individual's motivation, capacity, and proficiency in acquiring, comprehending, and applying information essential for advancing healthcare [3].

Health literacy, a multi-dimensional concept, extends to knowledge about oral diseases in dentistry and is influenced by an individual's literacy proficiency, psychosocial interactions,

and diverse health situations [4]. Oral health literacy (OHL) represents a comprehensive concept, encapsulating proficiencies in reading, writing, numeracy, effective communication, attentive listening, and sound decision-making skills [5]. Globally, the surge in interest surrounding OHL is fueled by disparities in oral health, particularly among vulnerable populations where conditions such as dental caries and periodontal disease substantially contribute to the global disease burden [6-10].

To assess an individual's health literacy, various tools have been developed, with a significant focus on the overall health commonly utilized in research investigations. The Health Literacy in Dentistry (HeLD) tool has emerged as a reliable, valid, and culturally acceptable instrument specifically designed to assess OHL among vulnerable populations. HeLD has demonstrated discriminative capabilities, revealing significant differences in three oral health perception factors—self-rated general health, self-rated oral health, and oral health impact [11]. In addition, the OHL-Adult Questionnaire (OHL-AQ) serves as a dependable tool for evaluating the functional aspect of adults' OHL within communities or populations [5].

The OHL-AQ, a pioneering instrument, assesses two crucial OHL-related skills—"listening" and "decision-making." It stands out for its brevity and ease of use and is applicable in both clinical and research settings to enhance oral health-related literacy skills and dentist-patient communication. Another noteworthy tool, REALMD-20, a concise screener for dental and medical health literacy, consists of 20 items featuring satisfactory psychometric characteristics [12]. The validity of this tool has been confirmed by correlating it with the Rapid Estimate of Adult Literacy in Medicine (REALM) [13] and the Test of Functional Health Literacy in Adults (TOFHLA) [14], which are widely accepted instruments for assessing medical health literacy.

As poor OHL emerges as a new public health challenge, the imperative for a dependable, valid, and culturally appropriate tool for its evaluation becomes evident. Within the past decade, advancements in defining health literacy have spurred the development of a diverse range of measurement instruments, encompassing a broad spectrum of abilities from reading comprehension to numerical proficiency. Notably, a study in Rajasthan revealed low OHL among children and teenagers, emphasizing the need for comprehensive interventions [15].

The rationale for the present research stems from the recognition that the university student population comprises individuals from diverse rural and urban backgrounds. By investigating their OHL, we aim to garner insights into their comprehensive oral health-related knowledge, acknowledging potential variations between students. The outcomes of this study will not only contribute to a better understanding of oral health needs specific to university students but will also facilitate comparisons between different scales used to measure OHL. Furthermore, these findings could inform educational interventions and public health strategies to promote better oral health outcomes among students from diverse regions. At present, there is a dearth of studies comparing different OHL scales, making this study pivotal in addressing this gap. The primary objective of this study is to compare OHL outcomes from

different scales in a selected population of university students in Jaipur, India.

2. Methods

This comparative study aimed to assess and compare the OHL levels of university students using three different scales: OHL-AQ, REALMD-20, and HeLD scales. This study was conducted in the Department of Public Health Dentistry at NIMS Dental College in Jaipur, India. The study involved 180 students from NIMS University, who were divided into three groups based on their course of study. Students who were 18 years or older and able to communicate in English were recruited and included in this study, while medical and paramedical students and those with incomplete questionnaires were excluded from the study. Ethical clearance was obtained before the study from the Institutional Ethics Committee of NIMS Medical College (protocol no.: NIMSUNI/IEC/2017/14). Written informed consent was obtained from all participants.

A pilot study was conducted with 10% of the population to test the feasibility of the study. The study pro forma was administered to 180 students, who had been divided into three groups: Group 1 (commerce, science, and humanity courses), Group 2 (engineering and architecture courses), and Group 3 (management courses). Sociodemographic information, such as name, age, sex, and course of study, was collected from each participant.

Three scales were used to measure students' OHL: OHL-AQ, REALMD-20, and HeLD. OHL-AQ is a 17-item questionnaire that assesses adults' OHL in community-based studies. The questionnaire had four sections: reading comprehension, numeracy, listening, and decision-making. Scores were divided into three categories: inadequate (0–9), marginal (10–11), and adequate (12–17).

REALMD-20 is a 20-item reading recognition test that screens basic dental health literacy and reading ability. The interviewer asked participants to read each word aloud. Scores were divided into three categories: inadequate (0–11), marginal (12–13), and adequate (14–20).

HeLD is a 29-item questionnaire that assesses OHL based on the constructs identified in the HeLMS. The questionnaire has seven domains: receptivity, understanding support, economic barriers, access, communication, and utilization. Scores were divided into three categories: inadequate (0–61), marginal (62–77), and adequate (78–116).

The completed questionnaires were collected and the data were entered into Microsoft Excel worksheets. The collected data were analyzed using IBM SPSS software for Windows, version 20 (IBM Corp., Armonk, N.Y., USA), and the results are expressed as means, standard deviations, and descriptive statistics. Independent sample *t*-tests and one-way ANOVA were performed to compare OHL levels between groups and between categories of scores on the literacy scales. Pearson's correlation coefficient was used to correlate the scores from the different literacy scales. Normality of the data was tested using the Shapiro–Wilk test. Data were normally distributed.

3. Results

In this study, there were a total of 180 participants, with 112 (62.22%) being male and 68 (37.78%) being female. The mean scores for HeLD in different domains, including receptivity, understanding, support, economic barriers, access, communication, and utilization [3], were 17.75, 10.55, 10.572, 10.439, 13.961, 24.89, and 14.27, respectively.

Independent sample *t*-tests were conducted to compare the mean OHLAQ, HeLD, and REALMD-20 scores based on gender. The results showed a statistically significant difference in mean OHL-AQ scores between males and females. However, the mean difference in HeLD scores between males and females was not statistically significant, with males scoring 101.16 and females scoring 104.56. The mean REALMD-20 score for males was 15.08, while for females, it was 16.74, and the difference between these scores was statistically significant (Table 1).

The study also compared the categories of scores (adequate, marginal, and inadequate) obtained using the different study tools. The results revealed a statistically significant difference between these categories. However, when comparing the mean OHL scores among the study groups using one-way ANOVA, the differences were not statistically significant (Table 2).

Finally, the study investigated the correlation between OHL-AQ and HeLD, HeLD and REALMD-20, and REALMD-20 and OHL-AQ using Pearson's correlation coefficient. The results showed a weak positive correlation (Pearson's correlation coefficient = 0.155) between these variables (Table 3).

4. Discussion

Adolescence represents a unique phase of human growth, characterized by not only physical but also emotional and cognitive changes. At the age of 18, these young individuals stand at the threshold of a new chapter in their lives, as society recognizes them as legal adults. This study recruited participants from colleges with diverse student backgrounds to capture the current state of OHL among undergraduate students. The students were recruited from various constituent colleges of NIMS University, Jaipur. The sampling approach was chosen to accommodate the study's requirement of having participants complete three questionnaires. Although English was not the primary language spoken in the participants' homes, the study was conducted in English because much of the health information in health-care settings is available in this language. The study tool was validated in English and not in the local language (Hindi).

In our study, we observed that the mean OHL-AQ scores for males and females differed, with females scoring higher in OHL. This finding contrasts with a study by Chowdhary *et al.* (2016) [16] in South India and Naghibi Sistani *et al.* (2014) [5] who found no gender difference in OHL. This discrepancy could be attributed to the fact that our study participants belonged to a younger age group. Similarly, Basir *et al.* [17] found that OHL scores were higher among females.

This study demonstrated a statistically significant difference between the score categories. In research conducted by

Table 1. Comparison of the mean OHL-AQ, HeLD, and REALMD-20 scores based on gender

Scales	N	Mean	SD	SEM	t-value	P-value
OHL-AQ						
Male	112	6.2	3.626	0.343	-3.548	0
Female	68	8.19	3.707	0.449		
HeLD						
Male	112	101.16	16.741	1.582	-1.5	0.135
Female	68	104.56	10.606	1.286		
REALMD-20						
Male	112	15.08	3.799	0.359	-3.213	0.002
Female	68	16.74	2.429	0.295		

Abbreviations: SD: Standard deviation; SEM: Standard error of the mean.

Table 2. Comparison of mean oral health literacy score among the study groups using one-way ANOVA

Scales	Group	N	Mean	SD	SE	F-value	P-value
OHL-AQ	1	60	6.77	3.788	0.489	0.991	0.373
	2	60	7.5	4.065	0.525		
	3	60	6.58	3.441	0.444		
HeLD	1	60	104.23	11.198	1.446	1.022	0.362
	2	60	102.7	15.084	1.947		
	3	60	100.4	17.401	2.246		
REALMD-20	1	60	16.3	2.316	0.299	2.298	0.103
	2	60	14.98	4.597	0.594		
	3	60	15.8	2.9	0.374		

Note: Group 1 comprises students pursuing commerce, science, and humanity courses; Group 2 comprises students pursuing engineering and architecture courses; Group 3 comprises students pursuing management courses. Abbreviations: SD: Standard deviation; SE: Standard error.

Table 3. Correlation between REALMD-20 and OHL-AQ using Pearson's correlation coefficient

Correlation	Mean	SD	N	Pearson's correlation coefficient	P-value
OHL-AQ and HeLD					
OHL-AQ	6.95	3.773	180	0.155	0.038
HeLD	102.44	14.786	180		
HeLD and REALMD-20					
HeLD	102.44	14.786	180	0.164	0.028
REALMD-20	15.71	3.436	180		
REALMD-20 and OHL-AQ					
REALMD-20	15.71	3.436	180	0.244	0.001
OHL-AQ	6.95	3.773	180		

Abbreviation: SD: Standard deviation.

Charophasrat *et al.* [18], they discovered a relatively high OHL score of 73.4% of participants demonstrating adequate OHL. This percentage was notably higher than that reported by Schaeffer *et al.* [19]. Conversely, a study conducted in Germany revealed that only 14.9% had excellent health literacy, 39.3% had sufficient health literacy, 33.7% had problematic health literacy, and 12.1% had inadequate health literacy [20]. Basir *et al.* [17] conducted a

cross-sectional study on 254 middle school students and reported that OHL level of 50.2% of the students was inadequate.

We also identified a weak positive correlation between OHL-AQ and HeLD, HeLD and REALMD-20, and between REALMD-20 and OHL-AQ, highlighting the distinct constructs measured by these instruments. Similar results were obtained in a study conducted by Devi [21] in 2011 in Bangalore city. The low correlation between the tested instruments can be attributed to the fact that these three instruments possess distinct constructs and measure different facets of OHL. REALMD-20 is a word-recognition test [12], OHL-AQ evaluates listening and decision-making skills [5], whereas HeLD accounts for the multidimensionality of OHL by encompassing the domains of communication, access, receptivity, understanding, utilization, support, and economic value [11].

In various research studies, a diverse set of assessment tools have been employed to gauge individuals' OHL. For instance, in one study, researchers utilized the REALMD-20 word-recognition tool along with the Comprehensive Measure of Oral Health Knowledge to assess conceptual knowledge [22] and also incorporated the Hong Kong OHL Assessment Task for pediatric dentistry as well as the Russian version of the OHL Instrument in separate investigations [23,24]. These instruments were chosen to evaluate reading comprehension and numeracy skills. It is important to note that all these assessment tools determine OHL by aggregating scores, where higher scores indicate a higher level of OHL.

However, contrasting results were obtained by Gong *et al.* [14], where they achieved strong evidence of a correlation between Test of Functional Health Literacy in Dentistry (TOFHLiD) and Rapid Estimate of Adult Literacy in Dentistry-99 (REALD-99). This may be due to the difference in the scales used to measure OHL. The reason for a strong correlation between TOFHLiD and REALD-99 may be due to the fact that both scales were derived from TOFHLA.

Using REALD instruments, we only tested a person's reading ability and could not capture comprehension, as reading is considered intermediate to decoding and comprehension [5]. This assessment tool lacks the capability to gauge word comprehension, posing challenges in discerning whether individuals who indicate English is not their primary language might be mispronouncing words they are familiar with and comprehend. It is known that there is a correlation between race, education, and considering English as a secondary language. One strategy involves emphasizing linguistically and culturally suitable communication methods during all interactions between patients and providers. This approach can be beneficial for individuals whose main language is not English and who face challenges not necessarily related to their knowledge of health terminology, but rather with pronunciation. Additional research is needed to examine the full array of literacy skills, including reading, writing, speaking, and listening [4]. This study encompassed undergraduate students from diverse academic backgrounds, excluding those in the health sciences. To gain a comprehensive understanding, future research is needed to explore a sample representative of all segments of society [5].

Despite recent research advances in the field of health literacy, specifically in the context of OHL, a notable gap remains in understanding the primary causes of poor oral health-related literacy skills, particularly in developing countries. Factors such as the scarcity of accessible oral health information resources, the presence of complex oral health instructions and brochures, and the lack of preparedness among dentists to assess patients' literacy needs have not yet been widely recognized. In Iran, for instance, a significant portion of oral health information materials, including medication labels, postdental treatment instructions, and oral health guidance, are provided in a foreign language, typically English. This linguistic barrier can pose considerable challenges for patients attempting to comprehend the information provided to them. Furthermore, dentists often utilize specialized dental jargon and numerous English terms, further complicating communication between dentists and patients [25]. Individuals with exceptionally low scores on health literacy assessments may encounter significant obstacles in their interactions with oral health providers. Thus, it is imperative to dedicate special efforts to developing culturally sensitive assessment tools tailored to the evaluation of OHL [7].

Naghibi Sistani *et al.* introduced and conducted a pilot test of the OHL Adults Questionnaire (OHL-AQ) to establish its validity and reliability [5]. The OHL-AQ comprises four sections: reading comprehension, numeracy, listening, and decision-making. This novel instrument was designed to overcome the shortcomings of current OHL assessments, which are often lengthy, lack applicability to diverse populations, and primarily focus on specific dental health terminologies or understanding oral health information and numerical calculations [26,27]. The authors concluded that the inclusion of two new measures (listening and decision-making) enhances the overall effectiveness and quality of existing instruments. They suggest that future research should involve a more extensive and diverse population, with a particular focus on exploring the factors influencing OHL, especially among individuals with limited general literacy skills [28,29].

Jones *et al.* [11] introduced the HeLD, building on the Health Literacy Measurement Scale (HeLMS) [13]. The theoretical constructs integrated into HeLD emphasize the significance of a person's ability to seek, comprehend, and apply oral health information, which is crucial for accessing and benefiting from oral health-care services. The researchers highlighted that studies utilizing HeLD can be of interest to both those working with marginalized and mainstream groups on OHL measurement. The authors envision several potential applications for this instrument. First, public dental services could employ it in health service evaluations to assess potential barriers to service delivery and service uptake, aiming to enhance attendance for oral care and potentially improve oral health impacts within communities. In addition, oral and allied health practitioners might use HeLD to conduct oral health needs assessments, both for communities and potentially for individuals they serve. Finally, HeLD could find applications in research studies aimed at exploring the factors influencing oral health and developing brief explanatory concepts for oral health outcomes. Charophasrat *et al.* [18] conducted

a study that revealed that individuals with an adequate level of literacy possess both proficient reading and critical thinking abilities, enabling them to apply information effectively to enhance their oral health. In addition, the study found that over 50% of the participants incorporated daily practices, such as flossing and using mouthwashes. These individuals demonstrate the ability to effectively apply their knowledge in various contexts, whether in their homes and communities while shopping in the marketplace, accessing oral health services, or recognizing their rights to access different services. Due to their enhanced OHL, it is not surprising that this particular group exhibits more favorable behaviors, such as regular use of oral hygiene tools like floss and mouthwash, as well as a higher frequency of dental check-ups in the past 6 months compared to individuals with limited OHL. These findings align with the health promotion model proposed by Nutbeam [30] and the health literacy model developed by Sørensen *et al.* [31].

Jones *et al.* [23] discovered that individuals with insufficient OHL tend to make fewer visits to dentists and have poor oral health. In addition, Baskaradoss *et al.* [32] revealed a connection between the OHL of caregivers and the dental status of children, as reflected in their DMFT/dmft scores.

According to Fazli *et al.* [33], demographic and socioeconomic factors are differentially correlated with oral health behaviors and oral health status. In contrast to our study, all students were of the same age and background; therefore, sociodemographic factors did not play a major role in the study.

The study was constrained by its relatively small sample size. Enrolling students from a wider range of courses can strengthen their validity. The presence of language barriers posed challenges during the research. It is important to note that this study focused on a specific area and did not include an assessment of sociodemographic factors.

In this study, we recommend that, due to low OHL, professionals or doctors should use local terminology when communicating with patients and limit the use of medical jargon. Doctors need to make extra efforts to ensure that patients understand the instructions given by doctors. Therefore, oral health awareness programs should be conducted to improve health literacy. Although the participants conversed in English with the examiner, their English fluency was not assessed. Hence, tools to assess literacy and English fluency should be incorporated in future research. Health professionals can identify knowledge gaps, comprehension difficulties, and misinterpretations by asking patients to explain their understanding of their condition and instructions. OHL contributes significantly to oral health, and improving it can prevent numerous oral diseases. Building navigable and accessible care systems is crucial for enhancing the health of the population. Efforts to enhance OHL and primary/secondary prevention are interconnected, leading to optimal oral health and early detection and treatment of oral diseases. Understanding oral health issues and the role of OHL will enable better care and education for at-risk populations. However, there are limited tests specifically designed to assess OHL.

5. Conclusion

This study categorized the scores into adequate, marginal, and inadequate levels. Adequate OHL is correlated with better oral health behaviors among students. Current tools tend to focus heavily on word-recognition, numeracy, and reading skills, and lack emphasis on health behaviors and service utilization. Specific population-adapted tools, ensuring acceptability and cultural competence, are necessary. In addition, tools should assess risk and effectively measure intervention-induced changes. The key practical challenge in assessing OHL in study groups revolves around the validation of assessment tools in the local language. Providing accessible information to those with inadequate literacy can promote behavioral changes and improve oral health outcomes. Oral health promotion programs should provide information at a comprehensible level for inadequately literate people, to foster behavioral changes and better oral health outcomes.

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Conflict of Interest

The authors declare that they have no competing interests.

Ethics Approval and Consent to Participant

Ethical clearance was obtained before the study from the Institutional Ethics Committee of NIMS Medical College (reference no.: NIMSUNI/IEC/2017/14) and written informed consent was obtained from all participants.

Consent for Publication

Not applicable.

Availability of Data

Data can be obtained from the corresponding author on request.

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