RESEARCH PAPER

Oral Health Literacy and Its Association With Sociodemographic Factors and Oral Health Outcomes: A Cross-Sectional Analysis from Odisha

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ABSTRACT

Background: Oral health literacy (OHL) is a fundamental determinant of oral health promotion and a key driver of health disparities in underserved populations. Poor OHL is associated with adverse oral health behaviors, reduced utilization of dental services, and worse clinical outcomes. This study aimed to investigate the prevalence and distribution of OHL levels among adults and examine its associations with sociodemographic characteristics and clinical oral health indicators.

Methods: A cross-sectional study was conducted among 200 adults residing in villages of Eastern Odisha. OHL was assessed using the validated Oral Health Literacy-Adult Questionnaire (OHL-AQ). Data collected included socioeconomic status (SES; assessed independently using BG Prasad's Classification), Decayed-Missing-Filled Teeth (DMFT) index, clinical attachment loss (CAL), and urgency for dental intervention (WHO Basic Methods). Statistical analyses included descriptive statistics and Pearson's chi-square test (significance set at $p<0.05$).

Results: Of 200 participants, 65.0% (n=130) had inadequate OHL, 21.0% (n=42) had marginal OHL, and only 14.0% (n=28) had adequate OHL. Higher OHL was significantly associated with higher educational attainment ($p=0.013$), lower prevalence of decayed teeth ($p<0.001$), lower clinical attachment loss ($p<0.001$), and lower urgency for dental intervention ($p<0.001$). No significant association was detected between OHL and sex ($p=0.561$) or SES category ($p=0.227$).

Conclusion: Inadequate OHL was highly prevalent in the study population. Educational attainment was identified as the strongest independent predictor of OHL. Tailored, evidence-based education initiatives are recommended to address deficiencies in OHL and associated oral health disparities.

Keywords: Clinical attachment loss; cross-sectional studies; dental caries; educational status; health literacy; oral health; preventive dentistry; socioeconomic factors

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INDRODUCTION

Oral health literacy has garnered increasing attention over the past decade as a primary and modifiable determinant of oral health status and disparities across diverse populations worldwide. Defined as the multidimensional ability to obtain, process, comprehend, and apply basic oral health information needed to make appropriate health care decisions, OHL influences not only preventive behaviors and oral hygiene practices, but also determines the timeliness of dental care seeking, adherence to treatment regimens, and long-term oral health outcomes.(1,2)

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Previous research has convincingly demonstrated that low OHL is significantly linked to higher caries experience, more severe periodontal disease burden, and worse oral health-related quality of life.(1,3,4) Systematic reviews by Firmino et al. (2017) and Baskaradoss (2018) confirmed that limited OHL results in poor utilization of dental services and higher prevalence of dental neglect, disproportionately affecting underserved groups(1,2) Multiple studies have also shown that OHL functions as a partial mediator of the effects of socioeconomic factors, educational attainment, and oral health behaviors such as brushing frequency on oral health outcomes.(2,5,6)

Substantial heterogeneity exists in the strength and direction of these associations across different geographic regions and populations. The development of culturally sensitive OHL instruments such as the OHL-AQ, OHLI, and REALD-30 has made it possible to directly quantify OHL and study its determinants across diverse settings.(7,8,9) In the Indian context, and specifically in states like Odisha which faces distinct public health challenges including high rates of dental disease, low per-capita income, predominantly rural population with limited access to dental services, and suboptimal oral health awareness understanding the mechanisms by which OHL shapes oral health behaviors and outcomes is essential for developing effective, locally appropriate interventions.(10,11)

Therefore, this study aimed to assess the prevalence and distribution of OHL levels among adults in Eastern Odisha and to examine their associations with sociodemographic characteristics and key clinical oral health indicators using a validated assessment tool.

Methods

Study Design and Setting

A descriptive, cross-sectional study was conducted among adults aged 18 years and above residing in 5 villages of Eastern Odisha. The study was designed following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines(12)

Participants and Data Collection

All adults residing in the selected households were eligible for inclusion, with the exception of those unable to comprehend the Odia language or who did not provide informed consent. Informed consent was obtained from all participants in accordance with the Declaration of Helsinki.

Sample Size Calculation

The sample size was calculated using the standard formula for estimating a population proportion:

$$n = Z^2p(1-p)/d^2$$

Based on prior regional literature reporting approximately 13.5% prevalence of adequate OHL in similar adult populations,(13) with 95% confidence (Z=1.96) and 5% precision (d=0.05), the minimum calculated sample size was 180 participants. Adjusting for an anticipated 10% non-response rate, the final target sample size was 200 participants..

Sampling Technique

A multistage cluster sampling technique was used for participant selection. Khordha district consists of 10 administrative blocks and about 1,534 villages overall, with roughly 130 villages in each block. In the first stage, one block was selected from the 10 blocks by simple random sampling using the lottery method.

In the second stage, five villages were selected from the chosen block by simple random sampling from the village list available for that block. In the third stage, households within each selected village were approached systematically until the required sample was obtained, and all eligible adults aged 18 years and above in the selected households were invited to participate. To achieve the final sample size of 200, approximately 40 participants were included from each of the five selected villages.

Adults who were unable to comprehend the Odia language, were unwilling to provide informed consent, or were not available at the time of data collection were excluded. This approach ensured geographic representation while remaining feasible for field-based community data collection in a rural district setting

Questionnaire and Data Collection

Participants completed a structured interview-administered questionnaire in the Odia language. The questionnaire comprised three components:

1. **Sociodemographic information:** Age, sex, educational attainment, household size, and SES (assessed using the updated BG Prasad Classification(14)

2. **Oral health behaviors:** Frequency of tooth brushing (once/twice daily; method used), frequency of dental visits (routine/emergency), and use of interdental aids.
3. **Oral Health Literacy:** Assessed using the OHL-AQ (described below).

Data Collection and Translation

Data were collected digitally using a structured electronic questionnaire administered on a tablet/mobile device by trained field investigators. The OHL-AQ, originally developed in English, was translated into Odia using a rigorous forward-backward translation protocol. First, the questionnaire was translated from English into Odia by a bilingual expert proficient in both languages. The translated version was then independently back-translated into English by a second bilingual expert who had no prior exposure to the original English version. Discrepancies between the original and back-translated versions were reviewed and resolved by a panel of experts through consensus. The Odia version was subsequently subjected to face validity and content validity assessment by a panel of subject matter experts including dental professionals and public health specialists, who evaluated each item for clarity, comprehensibility, cultural appropriateness, and relevance to the target population. Minor linguistic refinements were made based on expert feedback before finalizing the instrument. The validated Odia version of the OHL-AQ was then used for digital data entry, ensuring standardized and accurate capture of participant responses in the field.

Clinical assessment was performed following standardized WHO oral health survey methodology (5th edition, 2013) (15). Parameters recorded included the DMFT index (Decayed, Missing, and Filled Teeth) and Clinical Attachment Loss (CAL). Urgency for dental intervention was graded on a five-point scale (0=no treatment needed; 1=preventive/routine care; 2=prompt treatment including scaling; 3=immediate treatment due to pain/infection; 4=referral for comprehensive evaluation).

Oral Health Literacy Measurement

OHL was assessed using the Oral Health Literacy-Adult Questionnaire (OHL-AQ), a validated, 17-item instrument developed by Naghibi Sistani et al. (2013) specifically for assessing adult oral health literacy.[15] The tool encompasses four cognitive domains: reading comprehension, numeracy, listening comprehension, and decision-making in oral health contexts. Scores were classified as: inadequate (0–9), marginal (10–11), and adequate (12–17) based on the original validated cut-offs (16).

Data were analyzed using IBM SPSS Statistics version 23. Descriptive statistics (frequencies, percentages, mean ± SD) were computed for all variables. Bivariate associations between OHL categories and independent variables were evaluated using Pearson's chi-square test. Pearson's correlation coefficient was computed to assess linear associations between OHL score and continuous/ordinal variables (education, SES). Statistical significance was set at $p<0.05$. Internal consistency of the OHL-AQ was confirmed by Cronbach's alpha (>0.70).

Results

Sample Demographics

A total of 200 participants were included in the final analysis (Table 1). The mean age was 46.91 years (SD 12.80; range 18–80 years). The study included 135 males (67.5%) and 65 females (32.5%). The majority of participants had middle school (26.5%) or high school (28.0%) education; 18.0% were illiterate. SES distribution was predominantly Class III (Middle, 38.0%) and Class IV (Lower Middle, 34.5%) by BG Prasad's Classification.

Distribution of Oral Health Literacy

As shown in Figure 1, the distribution of oral health literacy categories among the 200 study participants, the majority of participants (65.0%, n=130) demonstrated inadequate OHL, while 21.0% (n=42) were classified as having marginal OHL and only 14.0% (n=28) achieved adequate OHL scores, indicating a heavily skewed distribution toward poor oral health literacy in this rural adult population.

Figure 2 presents the distribution of OHL categories stratified by educational attainment. A clear and consistent gradient was observed: participants with higher levels of education demonstrated progressively lower proportions of inadequate OHL and higher proportions of adequate OHL. Among illiterate participants (n=36), 83.3% had inadequate OHL, whereas among those with intermediate or diploma-level qualifications (n=13), this proportion fell to 38.5%, with adequate OHL rising to 38.5%. This pattern was statistically significant ($\chi^2=22.425$, df=10, p=0.013) with a positive Pearson correlation (r=0.166, p=0.019), confirming that higher educational attainment was significantly associated with better oral health literacy.

Figure 3 depicts the distribution of clinical attachment loss (CAL) across the three OHL categories. Among participants with inadequate OHL, 98.5% (n=128) had clinical attachment loss, compared to 81.0% (n=34) in the marginal group and only 35.7% (n=10) in the adequate OHL group. Conversely, 64.3% (n=18) of participants with adequate OHL had no CAL, compared to just 0.8% (n=1) in the inadequate OHL group. This stark gradient across OHL categories was highly statistically significant (χ^2=419.14, p<0.001), underscoring the strong association between poor oral health literacy and greater periodontal disease burden in this population.

Fig. 1. Distribution of Oral Health Literacy (OHL) Categories in the Study Population (n=200)

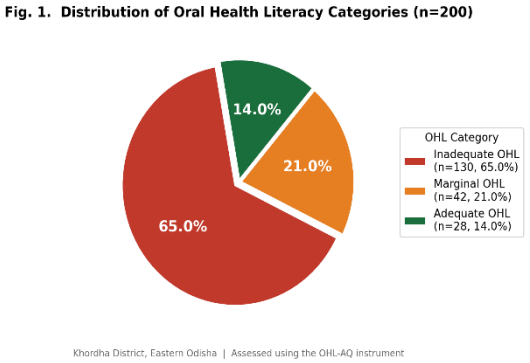


Fig. 2. Oral Health Literacy Distribution by Education Level

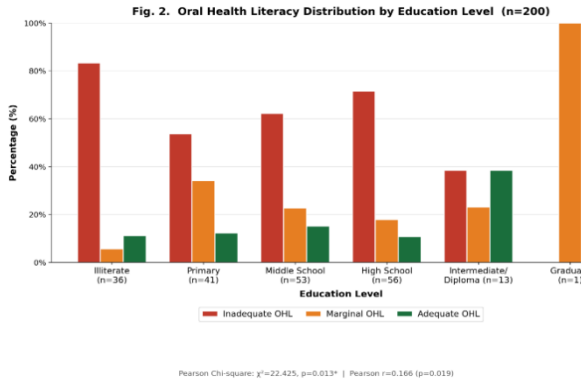
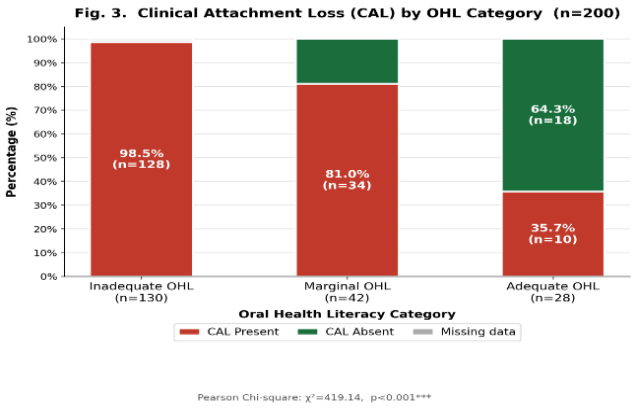


Fig. 3. Clinical Attachment Loss Severity Distribution by OHL Category



Association with Sociodemographic Factors (Table 1)

A statistically significant association was observed between educational attainment and OHL category (χ^2=22.425, df=10, p=0.013). No significant associations were found between OHL and sex (χ^2=1.156, df=2, p=0.561), SES (χ^2=10.579, df=8, p=0.227), or age (χ^2=104.230, df=102, p=0.420).

Association with Clinical Oral Health Parameters (Table 2)

Presence of decayed teeth was significantly associated with inadequate OHL (χ^2=125.388, df=2, p<0.001): all 130 participants with inadequate OHL had decayed teeth, whereas 23 of 28 participants (82.1%) with adequate OHL had no decayed teeth. Clinical attachment loss was similarly and significantly associated with OHL category (χ^2=419.140, p<0.001). A strong gradient was observed for intervention urgency (χ^2=220.440, df=8, p<0.001): all 78 participants requiring immediate treatment due to pain or infection had inadequate OHL, while 20 of 26 participants with no treatment needs had adequate OHL.

Correlation Analysis (Table 3)

Pearson's correlation analysis confirmed a significant positive correlation between education level and OHL score (r=0.166, p=0.019). SES showed a significant negative correlation with OHL score (r=−0.213, p=0.002), indicating that lower SES was associated with lower OHL when treated as a continuous variable.

Tables

Table 1: Association of Oral Health Literacy with Sociodemographic Factors (n=200)

Variable	Total n (%)	Inadequate OHL n (%)	Marginal OHL n (%)	Adequate OHL n (%)	p-value
Sex					**0.561**
Male	135 (67.5)	91 (45.5)	27 (13.5)	17 (8.5)	
Female	65 (32.5)	39 (19.5)	15 (7.5)	11 (5.5)	
Total	**200 (100.0)**	**130 (65.0)**	**42 (21.0)**	**28 (14.0)**	
Education					**0.013***
Illiterate	36 (18.0)	30 (15.0)	2 (1.0)	4 (2.0)	
Primary school	41 (20.5)	22 (11.0)	14 (7.0)	5 (2.5)	
Middle school	53 (26.5)	33 (16.5)	12 (6.0)	8 (4.0)	
High school	56 (28.0)	40 (20.0)	10 (5.0)	6 (3.0)	
Intermediate/Diploma	13 (6.5)	5 (2.5)	3 (1.5)	5 (2.5)	
Graduate	1 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)	
Total	**200 (100.0)**	**130 (65.0)**	**42 (21.0)**	**28 (14.0)**	
SES (BG Prasad)					**0.227**
Class I (Upper)	4 (2.0)	3 (1.5)	0 (0.0)	1 (0.5)	
Class II (Upper Middle)	34 (17.0)	24 (12.0)	6 (3.0)	4 (2.0)	
Class III (Middle)	76 (38.0)	41 (20.5)	21 (10.5)	14 (7.0)	
Class IV (Lower Middle)	69 (34.5)	47 (23.5)	13 (6.5)	9 (4.5)	
Class V (Lower)	17 (8.5)	15 (7.5)	2 (1.0)	0 (0.0)	
Total	**200 (100.0)**	**130 (65.0)**	**42 (21.0)**	**28 (14.0)**	
Age (years)					**0.420**

Mean ± SD	46.91 ± 12.80	—	—	—	
Range	18–80	—	—	—	

*Statistical test: Pearson's chi-square. *p<0.05*

Table 2: Association of Oral Health Literacy with Clinical Oral Health Parameters (n=200)

Variable	Total n (%)	Inadequate OHL n (%)	Marginal OHL n (%)	Adequate OHL n (%)	p-value
Decayed Tooth					**<0.001 *** **
Absent	29 (14.5)	0 (0.0)	6 (3.0)	23 (11.5)	
Present	171 (85.5)	130 (65.0)	36 (18.0)	5 (2.5)	
Total	**200 (100.0)**	**130 (65.0)**	**42 (21.0)**	**28 (14.0)**	
Clinical Attachment Loss (CAL)					**<0.001 *** **
Absent	27 (13.5)	1 (0.5)	8 (4.0)	18 (9.0)	
Present	172 (86.0)	128 (64.0)	34 (17.0)	10 (5.0)	
Missing data	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)	
Total	**200 (100.0)**	**130 (65.0)**	**42 (21.0)**	**28 (14.0)**	
Intervention Urgency					**<0.001 *** **
0 = No treatment needed	26 (13.0)	1 (0.5)	5 (2.5)	20 (10.0)	
1 = Preventive/routine treatment	34 (17.0)	1 (0.5)	27 (13.5)	6 (3.0)	
2 = Prompt treatment (incl. scaling)	45 (22.5)	41 (20.5)	4 (2.0)	0 (0.0)	
3 = Immediate (pain/infection)	88 (44.0)	78 (39.0)	6 (3.0)	4 (2.0)	

4 = Referred for evaluation	7 (3.5)	5 (2.5)	2 (1.0)	0 (0.0)	
Total	**200 (100.0)**	**130 (65.0)**	**42 (21.0)**	**28 (14.0)**	

*Statistical test: Pearson's chi-square. ***p<0.001*

Table 3: Summary of Chi-square and Correlation Analysis of Variables with Oral Health Literacy (n=200)

Variable	Total n (%)	Inadequate OHL n (%)	Marginal OHL n (%)	Adequate OHL n (%)	Chi-square (df)	p-value	Pearson r (p-value)
Sex					1.156 (2)	0.561	—
Male	135 (67.5)	91 (45.5)	27 (13.5)	17 (8.5)			
Female	65 (32.5)	39 (19.5)	15 (7.5)	11 (5.5)			
Education					22.425 (10)	**0.013***	r=0.166; p=0.019*
Illiterate	36 (18.0)	30 (15.0)	2 (1.0)	4 (2.0)			
Primary	41 (20.5)	22 (11.0)	14 (7.0)	5 (2.5)			
Middle school	53 (26.5)	33 (16.5)	12 (6.0)	8 (4.0)			
High school	56 (28.0)	40 (20.0)	10 (5.0)	6 (3.0)			
Intermediate/ Diploma	13 (6.5)	5 (2.5)	3 (1.5)	5 (2.5)			
Graduate	1 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)			
SES					10.579 (8)	0.227	r=−0.213; p=0.002**
Class I	4 (2.0)	3 (1.5)	0 (0.0)	1 (0.5)			
Class II	34 (17.0)	24 (12.0)	6 (3.0)	4 (2.0)			
Class III	76 (38.0)	41 (20.5)	21 (10.5)	14 (7.0)			
Class IV	69 (34.5)	47 (23.5)	13 (6.5)	9 (4.5)			
Class V	17 (8.5)	15 (7.5)	2 (1.0)	0 (0.0)			

Age (years)	Mean 46.91 ± 12.80	—	—	—	104.230 (102)	0.420	—
Decayed Tooth					125.388 (2)	**<0.001*** **	—
Absent	29 (14.5)	0 (0.0)	6 (3.0)	23 (11.5)			
Present	171 (85.5)	130 (65.0)	36 (18.0)	5 (2.5)			
CAL					419.140 (9)	**<0.001*** **	—
Absent	27 (13.5)	1 (0.5)	8 (4.0)	18 (9.0)			
Present	172 (86.0)	128 (64.0)	34 (17.0)	10 (5.0)			
Intervention Urgency					220.440 (8)	**<0.001*** **	—
0 = No treatment	26 (13.0)	1 (0.5)	5 (2.5)	20 (10.0)			
1 = Preventive/routine	34 (17.0)	1 (0.5)	27 (13.5)	6 (3.0)			
2 = Prompt treatment	45 (22.5)	41 (20.5)	4 (2.0)	0 (0.0)			
3 = Immediate	88 (44.0)	78 (39.0)	6 (3.0)	4 (2.0)			
4 = Referred	7 (3.5)	5 (2.5)	2 (1.0)	0 (0.0)			

*Statistical tests: Pearson's chi-square; Pearson's correlation. *p<0.05; **p<0.01; ***p<0.001*

Discussion

This study found that 65.0% of adults in Eastern Odisha had inadequate OHL, with only 14.0% achieving adequate OHL. The mean OHL-AQ score was 8.23 (SD 2.67), substantially lower than the mean score of 12.4 (SD 3.2) reported by Sabbahi et al. (2009) in the original OHL-AQ validation study conducted among Canadian adults.[7] This discrepancy highlights the substantial gap in oral health literacy levels between developed and developing country populations and points to an urgent need for health literacy-oriented public health interventions in the Indian context.

OHL Prevalence and Comparison with Previous Studies

The high prevalence of inadequate OHL (65.0%) observed in this study is consistent with findings from similar low-resource settings. Naghibi Sistani et al. (2013), in a study of Iranian adults, reported that 58.7% had poor OHL scores, also using the OHL-AQ, with education identified as the strongest determinant.[5] Baskaradoss (2018), in a cross-sectional study among Saudi adults, found that 54% of participants had limited OHL.[2] In India specifically, a study by Adyanthaya and Sequeira (2020) conducted in Udupi reported that only 12.5% of adults achieved high OHL, a finding strikingly similar to the 14.0% adequate OHL rate in the present study (17). Assessment of rural adults in Bareilly by Agarwal et al. (2025) similarly documented predominant moderate-to-low OHL with a strong positive correlation between OHL and oral hygiene practices (r=0.61, p<0.001), echoing our findings (18)

Educational Attainment as the Primary Determinant

The significant positive association between educational attainment and OHL (χ^2=22.425,

p=0.013; r=0.166, p=0.019) observed in this study is biologically and socially plausible. Formal education directly enhances foundational literacy skills — including reading comprehension, numeracy, and the ability to critically process health-related information — all of which constitute the core cognitive domains assessed by the OHL-AQ. Higher educational attainment equips individuals with a greater capacity to understand dental health instructions, interpret clinical information, and make informed decisions regarding oral self-care and treatment-seeking.

This finding is consistent with multiple prior investigations. Naghibi Sistani et al. (2013) reported that education was the dominant predictor of OHL in their Iranian study population, with participants who had only primary school education scoring significantly lower on the OHL-AQ than those with higher education.5 Parker and Jamieson (2010) similarly found in Indigenous Australian adults that education level was the strongest predictor of self-reported oral health outcomes mediated through OHL.(6) In the present study, only 14.0% of participants were graduates or held diplomas; this low educational profile of the study population likely underlies the high prevalence of inadequate OHL observed.

Socioeconomic Status and Sex

In this study, the chi-square analysis did not demonstrate a significant categorical association between SES and OHL (p=0.227). A plausible explanation lies in the relative socioeconomic homogeneity of our study population: since all participants were recruited from rural villages within a single administrative block of Khordha district, the range of SES variation was narrower than in studies conducted across mixed urban-rural or socioeconomically diverse populations. The majority of participants (73%) were classified within Class III and Class IV (middle and lower-middle strata) by BG Prasad's Classification, which may have limited the statistical power of the chi-square test to detect between-group SES differences. However, Pearson's correlation analysis did reveal a significant negative linear association (r=−0.213, p=0.002), suggesting that when SES is treated as a continuous variable, lower SES is indeed associated with lower OHL scores. This discrepancy between chi-square and correlation findings points to a real but attenuated relationship, partially masked by the rural socioeconomic homogeneity of our sample.

Batista et al. (2018), in a Brazilian adult cohort drawn from both urban and rural settings, reported that both income and education independently predicted OHL (19). Baskaradoss (2018) reported a pattern similar to ours, where SES did not independently predict OHL after accounting for educational level (2). The absence of a significant gender difference in OHL (p=0.561) is consistent with findings from Baskaradoss (2018) and Naghibi Sistani et al. (2013), though some studies, such as Parker and Jamieson (2010), have reported sex differences in specific populations.(2,5,6)

OHL and Dental Caries

In this study, 100% of participants with inadequate OHL had decayed teeth, compared to only 17.9% of those with adequate OHL (χ^2=125.388, p<0.001). This strong association is mechanistically explained by the fact that individuals with poor OHL are less able to understand the importance of preventive behaviors such as twice-daily brushing, fluoride toothpaste use, and timely dental visits — all of which are protective against dental caries. Without the ability to comprehend and act on oral health information, disease-preventive behaviors are not adopted, allowing caries to develop and progress untreated.

This finding is consistent with the systematic review by Firmino et al. (2017), which encompassed 26 studies and concluded that limited OHL was consistently and significantly associated with higher caries experience across diverse populations(1). Yazdani et al. (2019) similarly reported that lower OHL was significantly associated with higher DMFT scores in Iranian adults, further supporting the link between poor health literacy and accumulation of carious lesions (20). Gambhir et al. (2014), in a cross-sectional study of 450 rural adults in North India, also found that the majority (60.2%) of participants with low OHL scores had poor dental health, with a significant association between OHL and educational attainment (p<0.05) (13)

OHL and Periodontal Health

In the present study, 98.5% of participants with inadequate OHL had clinical attachment loss, compared to only 35.7% of those with adequate OHL (χ^2=419.140, p<0.001). This striking association is mechanistically grounded: individuals with inadequate OHL are less likely to understand the significance and implication of gingival bleeding, plaque accumulation, or early signs of periodontitis, and therefore less likely to seek timely periodontal care or adhere to oral hygiene instructions. Without comprehension of the link between plaque control and periodontal health, preventive and early interceptive behaviors

are neglected, allowing attachment loss to develop and progress.

This finding corroborates the results of Wehmeyer et al. (2014),(3) who in a cross-sectional study of 890 US adults reported that participants with limited OHL were significantly more likely to have periodontal disease, independent of other confounders. Bado et al. (2022), in a Brazilian cross-sectional study of primary health care users, similarly demonstrated that participants with low OHL levels presented with more severe periodontal disease, concluding that OHL assessment should be integrated into routine periodontal management (21). Sun et al. (2021), in a bibliometric analysis of OHL literature, noted that the OHL–periodontal disease association has emerged as one of the most consistently replicated findings in the field.(22)

OHL and Urgency for Dental Intervention

The distribution of intervention urgency scores across OHL categories was particularly striking. All 78 participants requiring immediate treatment due to pain or active infection (code 3) had inadequate OHL, while 20 of 26 participants needing no treatment (code 0) had adequate OHL. This pattern suggests that inadequate OHL contributes to delayed care-seeking, allowing dental disease to progress to the point of requiring urgent intervention. This finding aligns with Burgette et al. (2016) (23) who demonstrated in a US-based study that low OHL was significantly associated with reduced dental utilization, and with Horowitz and Kleinman (2012) (8), who highlighted OHL as a key pathway through which disadvantaged individuals accumulate untreated oral disease burden.

Implications for Practice and Policy

Collectively, these findings suggest that OHL-targeted interventions particularly those addressing educational gaps are critical for improving oral health outcomes in Eastern Odisha. Practical strategies may include: development of visually oriented, low-literacy educational materials in Odia; patient-centered communication training for dental professionals and community health workers; and integration of OHL screening into routine dental practice. Blizniuk et al. (2015) demonstrated that brief, structured OHL interventions in community settings were associated with improved oral health behaviors in a Belarusian adult population (24) Hom et al. (2010) similarly showed that improved caregiver OHL was associated with better early childhood oral health outcomes (25). These findings reinforce the potential for OHL-focused public health programs to generate meaningful improvements at the population level.

Limitations

This cross-sectional design limits causal inference; longitudinal or interventional studies are needed to establish the direction and magnitude of associations observed. The self-reported nature of some behavioral items, such as tooth brushing frequency, may be subject to recall and social desirability bias. Generalizability of findings to urban, remote, or differently structured populations may be limited. Residual confounding by unmeasured variables — including oral health beliefs, fear of dental treatment, and structural barriers to access — cannot be excluded. Future research should apply structural equation modeling to better delineate the causal pathways between OHL, education, SES, and clinical outcomes.

Conclusion

This cross-sectional study demonstrates that inadequate OHL is highly prevalent in adults of Eastern Odisha, affecting 65.0% of the study population, with only 14.0% demonstrating adequate OHL. Educational attainment was identified as the strongest and most consistent determinant of OHL, with significant associations also observed with dental caries, clinical attachment loss, and urgency for dental intervention. These findings reinforce the need for OHL promotion to be integrated as a central pillar of oral public health policy and clinical dental practice in the region, with particular focus on less-educated and economically disadvantaged communities.

List of Abbreviations

- **CAL:** Clinical Attachment Loss
- **DMFT:** Decayed, Missing, Filled Teeth
- **LMIC:** Low- and Middle-Income Country
- **OHL:** Oral Health Literacy
- **OHL-AQ:** Oral Health Literacy-Adult Questionnaire
- **SES:** Socioeconomic Status
- **STROBE:** Strengthening the Reporting of Observational Studies in Epidemiology
- **WHO:** World Health Organization

Declarations

Consent for publication: Not applicable.

Availability of data and materials: All data generated and analyzed in this study are included in this published article and its supplementary files, and are available from the corresponding author on reasonable request.

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