



Relationship between oral health literacy and periodontal health

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ABSTRACT

Objectives

The objective of this study was to describe oral health literacy and its association with periodontal health status.

Methods

A population of young adults, enlisted personnel, at a military police force at Escola da Guarda (EG - GNR) in Portalegre, Portugal, participated in this cross-sectional study. Information on sociodemographic, dental and oral health literacy was collected. Oral health literacy was assessed using OHLI (Oral Health Literacy Instrument). Clinical periodontal examinations were performed, and data was obtained for oral hygiene status and severity of gingival inflammation.

Results

A total of 274 participants enrolled and completed the study. Most participants (54.7 percent) had an adequate oral health literacy level. For 38 percent the level of literacy was marginal and, 7.3 percent had an inadequate level of oral health literacy. There is an association between education and oral health literacy ($P < 0.001$). Female participants had more general oral health knowledge than males ($P = 0.034$). Participants with the 12th grade or less have statistically significant less general oral health knowledge than participants with a bachelor's degree ($P < 0.001$). Dental plaque index was lower for participants with higher attendance of dental appointments ($P = 0.002$) and adequate oral health literacy ($P = 0.009$).

Conclusions

Oral health literacy, education and frequency of dental appointments were associated. General oral knowledge is worst for males and people with lower education levels. Oral hygiene status is better for participants with adequate oral health literacy and a higher number of dental appointments.

Keywords: Periodontal Disease, Oral Health, Literacy, Adult, Dental Hygiene

INTRODUCTION

Literacy is defined as a set of competences in the domains of reading, writing, basic calculation, language and its comprehension.¹ At an individual level, literacy is determined by vocabulary, numerical comprehension and ease in understanding definitions

that one possesses. Health literacy includes the ability of an individual to understand instructions on prescriptions, appointment slips, medical education brochures, medical staff directions and consent forms, it also includes the ability of an individual to negotiate complex health-care systems.² The

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development of competences in health literacy is essential for health and wellbeing, and results from cultural, social and individual factors.³ Amongst cultural factors, cognitive abilities are the most important and include the skill to process information and memory^{4,5} which influences, significantly, the comprehension of information.⁶ As for social factors, health literacy is influenced by social organization of health and educational systems, and by the interaction between the two¹ along with the conceptual knowledge of health.⁷ Amid the individual factors influencing health literacy, age, among others, is of relevance, as shown in the results of the Program for the International Assessment of Adult Competencies (PIAAC) 2012/2014 for the USA, which suggests a relationship between age and performance for the domains of literacy, numeracy, and problem solving in technology rich environments.⁸

Oral health literacy is the bridge between an individual and health context.^{9, 10} Its level, among dental patients, can be assessed using several tools, such as the REALD (Rapid Estimate of Adult Literacy in Dentistry) and the TOFHLiD (Test of Functional Health Literacy in Dentistry).^{11, 12} The REALD identifies inadequate knowledge of medical and dental terms but does not evaluate an individual's ability to understand the meaning of those terms.¹³ The TOFHLiD uses text excerpts and affirmations related to the use of fluorides and access to oral health care, to evaluate the ability to comprehend written information, as well as the perception of numerical values.¹² The use of these assessment tools has demonstrated that oral health literacy differs from general health literacy. In 2008, Sabbahi in Canada developed the OHLI (Oral Health Literacy Instrument).¹⁴ This instrument, in the form of a questionnaire, assesses oral health literacy and comprises two sections, the first section evaluates reading comprehension, and the second evaluates numerical information comprehension. Along with it, a general oral health knowledge questionnaire is also present, consisting of 17 items on oral structures, dental treatments, and dental hygiene instruments. This instrument was translated and validated into Portuguese language by the authors.¹⁵

Periodontal disease is a prevalent chronic inflammatory dental disease affecting soft and hard structures that support teeth. Its most severe form, periodontitis, is multifactorial and characterized by progressive destruction of the tissues surrounding teeth, can be successfully controlled.^{16, 17} In the United States, an estimate of 42% of dentate adults, 30 years or older, have periodontitis, with 7.8% having severe periodontitis. Severe periodontitis was most prevalent among adults 65 years or older.¹⁸ In the United Kingdom a study with 349 participants from a young-adult population, aged 18 to 35 years old, attending general dental practice for a routine dental examination, as part of the European Study in Non-Carious Cervical Lesions and Dentine Hypersensitivity, was developed. Results show that every participant had at least one tooth with gingival recession and 42% had recessions between 4 and 8 mm. In this population, widespread recession and gingivitis were present.¹⁹

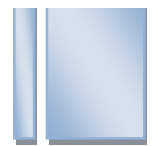
Oral health literacy impacts on oral health as a mediator and not as a direct factor for oral conditions, it also influences periodontal disease since lower oral health literacy is related with more severe periodontal disease,² and the evaluation of a patient's oral health literacy may influence education and health promotion activities for periodontal patients.²⁰

The purpose of this investigation is to characterize a population of young adults, enlisted personnel, at a military police force at Escola da Guarda (EG - GNR) in Portalegre, Portugal, on oral health literacy level and its relationship with periodontal health status. To our knowledge, this is the first study to evaluate oral health literacy level in enlisted personnel in military schools.

MATERIAL AND METHODS

Participants and Data Collection

Participants were recruited from enlisted personnel at Escola da Guarda, for an initial presentation of the project and its purpose. All the 274 enlisted agreed to participate. Written informed consent forms were obtained for study participation. The study was approved by the Health Ethics Committee of the Dental Medicine Faculty of the University of Lisbon



and authorized by the EG-GNR high command. All participants met the following inclusion criteria: a) enlisted in Escola da Guarda; b) 19 years of age and older; c) possess cognitive and visual skills to fill out the test of general oral health knowledge and OHLI.

Oral Health Literacy Assessment

Oral health literacy was assessed using OHLI.¹⁵ This previously validated instrument (Cronbach's $\alpha = 0.81$) is comprised of two sections. The first evaluates reading comprehension through 38 items, with omitted words from sentences about dental caries and periodontal disease. The second evaluates comprehension of numerical information through 19 items, about the ability of following medical indications related to medication after a medical appointment and a tooth extraction. Classification on this test is as it follows: 0-59 inadequate level of literacy; 60-74 marginal level of literacy, and 75-100 adequate level of literacy.¹⁴

One member of the study team was present during the process of filling out the OHLI and the general oral health knowledge questionnaire. Demographic data collected included age, gender and degree of education. Participants completed the test of general oral health knowledge and OHLI, in a process that took around 30 minutes.

Clinical Assessment

Following the questionnaire, an oral screening was completed by one of the four trained and calibrated examiners who were blinded to the results of the oral health literacy evaluation.

Oral hygiene status was determined based on the extension of bacterial plaque accumulation on the dental surfaces, using the Simplified Oral Hygiene Index from Green, Vermillion and Greene.^{21, 22} In this study, only the simplified deposit index (DI-S) was used. At least two of the six surfaces were observed, using the periodontal probe tip of a CP-12 color-coded periodontal probe (Hu-Friedy Manufacturing, Chicago, IL, USA), on the selected surface, according to Index criteria. DI-S index was calculated by the sum of the values of each surface, divided by the number of observed surfaces. DI-S values vary from 0

to 3 and classify 0 as Excellent; 0.1 to 0.6 as Good; 0.7 to 1.8 as Reasonable and 1.9 to 3 as Bad.

The severity of gingival inflammation was determined based on its color, consistency and bleeding on probing, using the Gingival Index (IG) from L oe and Silness.²³ Clinical periodontal parameters were measured using the same CP-12 color-coded periodontal probe (Hu-Friedy Manufacturing, Chicago, IL, USA). For a group of individuals, the index value consists of the sum of the individual values, divided by the total number of individuals in the group. The index assumes values from 0 to 3 and classifies 0 as Excellent; 0.1 to 1 as Good; 1.1 to 2.0 as Reasonable and 2.1 to 3 as Bad.

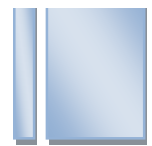
Before this study, with the purpose of evaluating intra and inter-observer calibration to minimize diagnosis variability and check for concordance, an observation of 30 individuals from Escola Superior de Sa de de Portalegre, with similar ages to those enlisted, was organized, as preconized by WHO²⁴. Duplications occurred every five observations for inter-observer calibration. The four calibrated observers presented an ICC value of 0.968 and a Cronbach alpha of 0.963 ($p=0.05$), indicating high consistency between the observers. Intra-observer calibration presented kappa values of 0.936; 0.921; 0.945 and 0.989 respectively, for each of the observers.

Data Analysis

After the introduction of all the information on a database, validation methods and quality control checks were performed, as to avoid the existence of systematic errors, or wrong inputted values that could skew or invalidate the results.

Statistical analysis comprised the descriptive analysis, using tables for all study variables. For nominal and ordinal variables, absolute and relative frequencies were calculated. For continuous variables, mean and standard deviation values were calculated for all individuals, and for each group of analysis. Adequate correlation matrixes between all the adequate variables were made.

The outcome variable was periodontal health status, and the primary explanatory variable was the OHLI.



Hypothesis tests were applied, such as chi-square or exact tests, respectively, Fisher and “linear-by-linear”, Mann-Whitney U tests, Kruskal-Wallis, or the corresponding parametric tests, every time the sample or type of variables made it possible. Statistical analysis was performed using SPSS 20 (SPSS Inc., Chicago, IL, USA).

RESULTS

A total of 274 participants were included in this study (table 1), the majority were male (89.4 percent). The average age was 24 years old [standard deviation (SD) 2.18]. Most participants had the 12th grade or less of education (77.8 percent) and 36 (13.1 percent) were University students. Only 3 (1.1 percent) of the participants had a Master or a Ph.D. degree.

Table 1 Sociodemographic Variables

Variables	Total	Frequency	Average	(SD) or percent (%)
Sex				
Male		245		89.4
Female		29		10.6
Total	274			
Age				
19-22		127		46.4
23-25		93	24.38	33.9
26-29		54		19.7
Total	274			(2.18)
Education				
12th grade or less		213		77.8
University student		36		13.1
Bachelor		22		8.0
Master's degree/PhD		3		1.1
Total	274			
Frequency of dental appointments				
2-4/year		128		46.7
1/year		70		25.5
<1/year		10		3.7
Only when needed		66		24.1
Total	274			

Results from the demographic survey showed that participants present a wide distribution of dentist appointments frequency and that 128 (46.7 percent) of the participants refer that they visit the dentist 2 to 4 times a year. Relevant values were also obtained for dental appointments once a year, with 70 (25.5 percent) of the participants doing it, and 66 participants (24.1 percent) referring visiting the dentist only when needed, with no defined periodicity.

The OHLI test results show (table 2) that the lowest score was 25 points, which represents an inadequate

level of oral health literacy. On the other hand, the highest score was 93.44 points, representing an adequate level of oral health literacy.

Participant's distribution by level of literacy is in Table 3, where it shows that most of the individuals, 150 (54.7 percent) possesses an adequate level of oral health literacy, 104 (38 percent) possesses a marginal level of oral health literacy, and 20 (7.3 percent) have an inadequate level of oral health literacy.



Table 2 OHLI Descriptive Values

OHLI Total Values	
N	274
Minimum	25.00
Maximum	93.44
Average	74.35
Standard Deviation	10.34

There is no statistically significant relationship between sex and oral health literacy ($P=0.279$) and between age group and oral health literacy ($P=0.199$). The study of the relation between education and oral health literacy presented statistically significant difference ($P<0.001$). Participants with the 12th grade or less presented statistically significant worst health

literacy level than participants with master’s or Ph.D. ($p=0.006$). The frequency of dental appointments is statistically different among the different levels of literacy ($P=0.028$) with participants with a higher frequency of visits being statistically different from participants that have no defined periodicity of visits.

Table 3 Distribution of Literacy Levels

Literacy levels	Frequency	Percent (%)
Inadequate	20	7.3
Marginal	104	38
Adequate	150	54.7

For the general oral health knowledge questionnaire, an average of 63.81 (14.11) points (out of 100) was found. Female participants had more general oral health knowledge than males ($P=0.034$), and participants with the 12th grade or less has statistically significant less general oral health knowledge than participants with bachelor’s degree ($P<0.001$). There were no statistically significant differences among the other education groups. The frequency of dental appointments also presented no statistically significant differences among the groups ($P=0.319$).

Periodontal health was evaluated using the Gingival Index (GI), from Löe and Silness. It presented an average value of 0.38 (0.39), which reflects good gingival health, with zero as the lowest value and 2 as the highest value registered, which matches a red, swollen gingiva with moderate inflammation, bright,

and with bleeding on probing. It is possible to see in table 4 that males present a higher value of GI, compared to women, although there is no statistically significant difference ($P=0.881$). Regarding age groups, participants between 26 and 29 years of age had the lowest GI score, on the other hand, the youngest had the highest GI score, but no statistical difference was found among the age groups ($P=0.513$). The participants who had completed 12th grade, or less, had an average GI value similar those with a Master’s Degree or a Ph.D., and superior to those with a Bachelor’s Degree, the latter being the ones with the lowest average GI score ($P=0.142$). Those who went to the dentist two to four times a year were the ones with the highest average GI score, but there was no statistically significant difference among the frequency of dental appointments groups ($P=0.053$).



The relationship between GI and the level of oral health literacy is not statistically significant ($P=0.128$). However, participants with an adequate level of literacy were the same who present the lowest average GI score, followed by participants

with marginal and inadequate levels of literacy. There was also no statistically significant relationship between the median score (64.7) in the general oral health knowledge test and the average GI scores ($P=0.372$).

Table 4 GI Mean Values and Sociodemographic Variables

Variables	Mean (SD)
Sex[†]	
Male	0.38 (0.39)
Female	0.37 (0.37)
Total	$P=0.881$
Age^{††}	
19-22	0.44 (0.43)
23-25	0.39 (0.39)
26-29	0.34 (0.34)
Total	$P=0.513$
Education^{††}	
12th grade or less	0.41 (0.40)
University student	0.32 (0.33)
Bachelor	0.21 (0.26)
Master's degree/PhD	0.41 (0.21)
Total	$P=0.142$
Frequency of dental appointments^{††}	
2-4/year	0.45 (0.43)
1/year	0.31 (0.33)
<1/year	0.24 (0.30)
Only when needed	0.34 (0.32)
Total	$P=0.053$

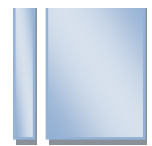
[†] T-test for independent samples ^{††} Kruskal-Wallis

The overall DI-S mean score was 0.94 (0.62), which represents reasonable levels of oral hygiene. In table 5, it is possible to see that there are significant statistical differences for the frequency of

appointments ($P=0.002$). None of the remaining sociodemographic variables present significant statistical differences.

Table 5 DI-S Mean Values and Sociodemographic Variables

Variables	Mean (SD)
Sex[†]	
Male	0.94 (0.63)
Female	0.93 (0.58)
Total	$P=0.803$
Age^{††}	
19-22	1.05 (0.67)
23-25	0.95 (0.63)
26-29	0.87 (0.58)
Total	$P=0.282$
Education^{††}	



12th grade or less	0.99 (0.64)
University student	0.85 (0,58)
Bachelor	0.71 (0.49)
Master's degree/PhD	0.88 (0.53)
Total	P=0.121
Frequency of dental appointments^{††}	
2-4/year	1.05 (0.62)
1/year	0.88 (0.63)
<1/year	0.33 (0.33)
Only when needed	0.91 (0.58)
Total	P=0.002

[†] Mann-Whitney U ^{††} Kruskal-Wallis

The comparison between the different categories of the variable "frequency of dental appointments", table 6, reveals that the frequency "less than once per

year" is statistically significantly different from the other categories.

Table 6 Comparison between Frequencies of Dental Appointments for the Mean Value of DI-S

Frequency of dental appointments	Adjusted p value
<1/year - Only when needed	0.015*
<1/year - 1/year	0.037*
<1/year - 2-4/year	0.010*
Only when needed - 1/year	1.000
Only when needed- 2-4/year	1.000
1/year- 2-4/year	0.359

*Statistically significant. Dunn-Bonferroni test

The study of the relationship between the DI-S index mean values and level of literacy in oral health shows a statistically significant different distribution (P = 0.009) among the categories of literacy level in oral health. The comparison between the different categories of the variable "literacy level in oral health" reveals that the level of "adequate" oral health literacy is statistically significantly different from the level of "marginal" oral health literacy (P = 0.010).

To study the relationship between the DI-S index and results from the general oral health knowledge test was used the median score of the test (64,7 points). Data analysis with the Mann-Whitney U test shows that there are no statistically significant differences between the results below the median score, and those above the median ($p=0,688$).

DISCUSSION

The present study indicates that a high percentage of participants has adequate oral health literacy (54.7%), with 38% having marginal oral health literacy and 7.3% inadequate oral health literacy. A study published in 2007, using REALD to assess oral health literacy and conducted in a private clinic setting with adult patients, indicates that 29% of individuals have low literacy²⁵ a lower value than in the present study if we consider that marginal and inadequate literacy corresponds to low literacy. The same article states that the fact that a visit to the dentist was not made in the last year does not influence the level of oral health knowledge of individuals,²⁵ as it is verified in the present work.

Other studies carried out in a dental clinic environment, show that oral health literacy is related to educational level, indicating that the higher the educational level, the higher the level of literacy in oral health,³³ being this same factor relevant for the



low literacy of adults.²⁶ These results are in line with those observed in the present study, which shows a statistically significant relationship between literacy in oral health and education ($p < 0.01$). In a study conducted with adults in a hospital emergency environment, relationships were found between being male and older with low health literacy.²⁶ In the present study, no relationship was found between gender, enrollment, or age and literacy in oral health. In the present study, it was found that female participants have more general oral health knowledge than male, which is similar to a study developed with young adults in Kuwait in 2007.²⁷ Knowledge of oral health is also related to a higher level of education, as described in the literature, especially in a study carried out in 1990 that shows that the written information available to the general public is elaborated in a type of language with 5 years of education above of the average found in the population.²⁸

Individuals with lower levels of literacy also present lower levels of oral health, as revealed by a study done in the United States of America.²⁹ In a study conducted in Japan,³⁰ and in the present study, no statistically significant relation was found between oral health literacy and DI-S, where a higher level of oral health literacy was related to a lower value of DI-S and GI.

In conclusion, this study demonstrated a significant association between oral health literacy, education, and frequency of dental appointments. General oral health knowledge is worse for males and people with lesser levels of education. Patients with better DI-S scores are the ones with adequate oral health literacy and with a higher number of dental appointments.

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