Relationship between oral health literacy and oral health behaviors, knowledge and dental status in Portuguese military enlisted adults

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ABSTRACT

Objectives
The objective of this study was to describe oral health literacy and its association with oral health behaviors, knowledge and dental status in Portuguese military enlisted adults.

Methods
The Portuguese version of the Oral Health Literacy Instrument (OHLI) was applied to 274 enlistees at the Escola da Guarda in Portalegre, Portugal, in a cross-sectional study. Information on sociodemographic, dental status and oral health literacy was collected.

Results
There is a high number (45.3%) of individuals with marginal or inadequate levels of literacy. Assessment of dental status also revealed oral health care needs. Females have better oral health knowledge than males (p=0.034) and individuals with a bachelor's degree have better oral health knowledge than those with at least high school (P<0.001). The higher number of visits to the dentist increases the number of filled teeth (p<0.001) and DMFT (p=0.01). The variables that influences DMFT the most are "frequency of dentist visits" (p<0.01) and "age group" (p=0.011).

Conclusion
There is the need for implementation and improvement of existing oral health promotion activities, namely the introduction of oral health topics in the curriculum and the implementation of an oral health education and promotion program for enlisted personnel at the Escola da Guarda.

Keywords: Oral Literacy, DMFT, Oral Health Knowledge, Enlisted, OHLI, Portugal

INTRODUCTION

The development of unique abilities about literacy leads to health literacy, which is fundamental to an individual's health and well-being.[1] Health literacy is the sum of cultural, social and individual factors, leading to cognitive skills that promote and maintain good health.[2-5] Oral health literacy is vital to allow good professional-patient communication[6-8] and is defined as the degree to which an individual can gather, process and understand basic oral health information, necessary to make appropriate health decisions.[9, 10] Like health literacy, oral health literacy is related with the ability to read, write and understand numbers.[11, 12] Health literacy needs to be quantified by the reading, listening and speaking abilities and cultural knowledge.[6, 13] Health promotion programs are considered to have the capacity to improve an individual's quality of life and literacy.[14]

Oral health literacy and oral health behavior are positively associated, increasing knowledge and awareness.[15] The demand for health care is strongly associated with literacy, socio-economic level and access to primary health care.[16, 17] Also, an association between healthy behaviors and well-being is essential to good health.[9, 18-20] A low level of health literacy is considered a risk factor for an individual's well-being since it is difficult for them to understand medical prescriptions, medical instructions, and exams. These individuals have more hospitalizations and higher expenses for health care.[6, 9, 17, 21]

Health systems success depends on an individual's comprehension of their rights and responsibilities to promote their health.[22] Individuals with low literacy present added difficulties accessing health care, as well as understanding recommendations and instructions given to them, resulting in poorer clinical results.[23-25] Even though good oral hygiene behaviors are fundamental to maintain good oral health, enlisted adults appear to have difficulties in effectively undertaking the duty. Given this, the enlisted oral self-care choices are an essential aspect of oral health behaviors which might lead to fewer numbers of oral treatments during training and recruitment.[26]

Dental caries is the most common chronic disease worldwide, affecting individuals throughout their life.[27] A carious lesion occurs when the equilibrium between demineralization and remineralization disappears, allowing the reduction of the minerals present in dental enamel.[28, 29] Numerous factors contribute to the progression of dental caries such as microbiology, genetics, immunology, diet and environment.[30]

There is evidence that links oral health literacy and behaviors to clinical dental outcomes, as stated before, lower oral health skills result in poorer outcomes. Thus, with this study, we aim to investigate how oral health literacy, behaviors and knowledge relates to the dental status of military enlisted adults in Portugal.

MATERIAL AND METHODS
Participants and Data Collection
Two hundred and seventy-four enlisted personnel at Escola da Guarda (military police force instruction center) participated in this study, after a presentation about the project and its purpose and signature of a written informed consent form. 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) been 19 years of age and older;
    c) Possess cognitive and visual skills to fill out the test of general oral health knowledge and Oral Health Literacy Instrument (OHLI).

The Questionnaire
Demographic data collected included age, gender and degree of education. Participants answered to the OHLI.[31, 32] This questionnaire evaluates oral health literacy and consists of two sections; the first one evaluates reading comprehension and the second evaluates numerical information comprehension.

The reading section comprises 38 items with omitted words from phrases about dental caries and periodontal disease. The numerical information comprehension evaluation comprises 19 items related to the ability to understand post-treatment care as well as the medication prescribed. The individual's classification in the questionnaire is obtained by the sum of the different sections results and is arranged in the following manner: 0-59 inadequate literacy level; 60-74 marginal; 75-100 adequate.

Along with the OHLI, a 17 items general oral health knowledge questionnaire, to identify oral anatomy structures and plaque removal instruments used in day-to-day oral hygiene care was applied.[31]

One member of the study team was present during the process of filling out the OHLI and the general oral health knowledge questionnaire. Participants completed the test of general oral health knowledge and OHLI, in around 30 minutes.

Oral Examination

Clinical examinations were conducted in a well-lit room by one of the four trained and calibrated examiners who were blinded to the results of the oral health literacy evaluation, using a dental mirror and a periodontal probe for the DMFT index.[33] Before this study, with the purpose of evaluating intra-observer and inter-observer calibration to minimize diagnosis variability and check for concordance, an observation of 30 individuals from Escola Superior de Saúde de Portalegre, with similar ages to those enlisted, was organized, as preconized by WHO.[33] 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.

Statistical Analysis

The results were analyzed using descriptive statistics with tables for all variables in the study. The absolute and relative frequencies were calculated for the nominal and ordinal variables. For the continuous variables, the mean values and standard deviation (SD) were calculated for the total number of participants and by analysis group. Adequate correlation matrices were constructed among all adequate variables. To calculate the linear association degree between two continuous variables, there were used linear correlation coefficients like Pearson, for continuous variables, or like Spearman, for non-continuous variables.

Hypothesis tests were performed to obtain answers to the main study hypothesis, such as: chi-square test or respective exact tests (such as Fisher or "linear-by-linear"), Mann–Whitney U tests, Kruskal-Wallis Tests (or ANOVA), or the corresponding parametric tests when the sample or type of variables require.

RESULTS

Demographics and Health Literacy

Among the 274 participants, 89.4 percent (n=245) were male and the remaining 10.6 percent female (n=29), the mean age being 24.38 ± 2.18. 46.7 percent of participants visited the dentist two to four times a year, 25.5 percent one time a year, 3.6 percent less than one time a year and 24.1 percent only visited the dentist when they needed. 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. Regarding the oral health literacy classification, study participants have adequate oral health literacy (54.7 percent), 38 percent have limited oral health literacy and 7.3 percent have an inadequate oral health literacy level.

Oral Health Knowledge and Demographic Data

The frequency of correct answers for the general oral health knowledge questionnaire (n=274) can be found in figure 1. Participants have an easier time identifying posterior teeth, lips and gingiva, dental caries and gingival hemorrhage, as well as dental prosthesis and oral hygiene instruments. On the other hand, very few participants could identify intra-oral structures and only 17.2 percent of participants could identify dental calculus.

For oral health knowledge, females are better than males (p=0.0034). For age groups, there are statistically significant differences (p = 0.019) been the age group of 23 to 25 years more knowledgeable about oral health than 26 to 29 years' age group (p=0.032).

The school level has a significant influence (p <0.01) on the results of the knowledge test, in fact the test values are significantly different among those with the Secondary School completed or less and those who hold a Bachelor's / Bachelor's degree (p <0.01).

The frequency of visits to the dentist did not influence the results of the general oral health knowledge test (p = 0.319).
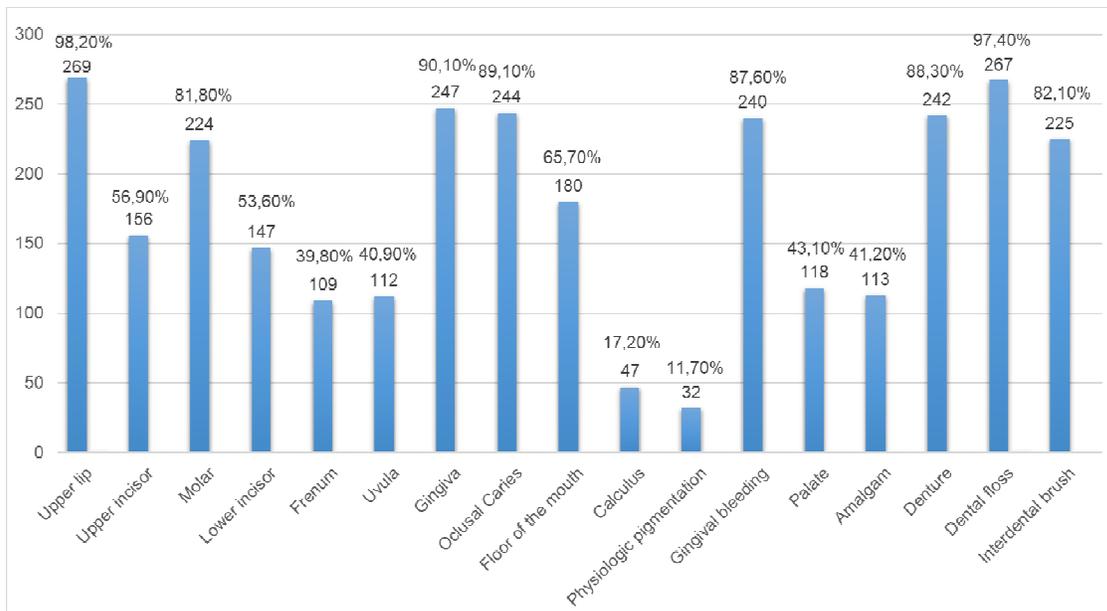
Fig 1 Number and Percent of Participants Who Could Correctly Identify the Oral Structures and Images

Dental Health Status and Demographic Data

The mean DMFT was 6.46 (±4.80), being the filled tooth component the main contributor for the index. The minimum DMF value is 0 and the maximum 22.

Fifty-one percent of participants are caries free. Table 1 shows the mean values for DMFT and each of its component according to demographic variables.

Table 1 Mean Value of Decayed, Missing and Filled Teeth and DMFT, according to Demographics

		Decayed teeth	Missing teeth	Filled Teeth	DMFT
		Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)
Gender[†]	Male	1,26 (1,995)	0,87 (1,537)	4,19 (3,815)	6,31 (4,764)
	Female	1,14 (1,787)	0,90 (1,952)	5,69 (3,920)	7,72 (5,084)
		$p=0,828$	$p=0,608$	$p=0,038*$	$p=0,143$
Age group[††]	19 to 22	0,80 (1,203)	0,39 (0,979)	3,83 (3,484)	5,02 (4,155)
	23 to 25	1,31 (1,909)	0,96 (1,738)	4,31 (3,833)	6,57 (4,905)
	26 to 29	1,43 (2,356)	1,02 (1,601)	4,69 (4,065)	7,14 (4,903)
		$p=0,321$	$p=0,016*$	$p=0,440$	$p=0,026*$
Educational level[††]	Complete High School (12 years of schooling) or less	1,46 (2,142)	0,89 (1,600)	4,37 (3,769)	6,72 (4,791)
	University student	0,56 (0,909)	0,92 (1,795)	4,08 (4,644)	5,56 (5,256)
	Bachelor degree	0,41 (0,796)	0,55 (0,963)	4,73 (3,411)	5,68 (4,122)
	Master/ Ph.D.	0,33 (0,577)	1,00 (1,732)	3,00 (3,000)	4,33 (5,132)
		$p=0,061$	$p=0,862$	$p=0,573$	$p=0,258$
Number of visits to the dentist[††]	Two to four times per year	1,30 (2,086)	1,12 (1,987)	5,30 (3,718)	7,70 (4,787)
	Once a year	0,87 (1,474)	0,61 (1,026)	4,09 (4,416)	5,57 (5,052)
	Not once a year	1,00 (1,633)	0,70 (1,337)	2,80 (3,553)	4,50 (4,950)
	Only when necessary	1,59 (2,205)	0,68 (1,098)	3,00 (2,935)	5,27 (3,994)
		$p=0,243$	$p=0,862$	$p<0,01*$	$p=0,01*$

Statistically significant [†] *Mann-Whitney U test* [††] *Kruskal-Wallis Test*

Comparing for gender, women have more filled teeth than man (p=0.038). There are statistically significant differences among the age groups for missing teeth (p=0.016) and DMFT (p=0.026). The significant differences among age groups, for missing teeth, can be verified between age groups 19 to 22 and 23 to 25 (p=0.049), and between 19 to 22 and 26 to 29 (p=0.016). For DMFT the age group 19 to 22 is statistically different of age group 26 to 29 (p=0.022).

The variable visit to the dentist shows statistically significant differences between the age groups for filled teeth (p <0.01) and DMFT (p = 0.01). Analysis of data reveals that there are statistically significant differences between those who attend the dentist only when they need it and those who visit two to four times a year (p <0.01) and also between the latter and those seeking the dentist once a year (p = 0.021). For DMFT, statistical differences are found for individuals who visit the dentist when they need it and those who visit two to four times a year (p = 0.009) and for individuals who visit the dentist once a year and those who do it two to four times a year (p = 0.007).

The variables that influences DMFT the most are "frequency of dentist visits" (p<0.01) followed by "age groups" (p=0.011).

DMFT by Oral Health Literacy
There is no significant association between the components of the DMFT index and the different level categories of the oral health literacy questionnaire, as shown in table 2. Participants with inadequate oral health literacy present higher DMFT, and also a higher mean number of decayed and missing teeth.

Table 2 Mean Value of DMFT by Level of Oral Health Literacy

		Decayed teeth Mean (SD)	Missing teeth Mean (SD)	Filled teeth Mean (SD)	DMFT Mean (SD)
Oral health literacy level	Inadequate	1.80 (2.668)	1.10 (1.518)	4.05 (3.379)	6.95 (4.161)
	Marginal	1.30 (1.827)	0.86 (1.622)	4.03 (3.477)	6.18 (4.504)
	Adequate	1.14 (1.963)	0.85 (1.570)	4.61 (4.142)	6.58 (5.103)
		p=0.402	p=0.461	p=0.752	p=0.644

DMFT by Oral Health Knowledge
For the study of the relationship between the DMFT index and the general knowledge test results, the median value of the general oral health test (64.7) was used to divide participants in two groups, indicating that 50% of the individuals obtained in the test a value below the median.

Data in table 3 indicates that participants with higher oral health knowledge have, in average, less decayed teeth (p=0.176), less missing teeth (p=0,069) and more filled teeth (p=0,793), and a lower mean value of the DMFT index (p=0.387), when compared with the participants with lower oral health knowledge, although none of the p values are statistically significant.

Table 3 Distribution of the DMFT Components among the Median Value of the General Oral Health Knowledge Test

		Decayed teeth	Missing teeth	Filled teeth	DMFT
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
General Oral Health Knowledge	Below mean average	1.36 (1.965)	1.10 (1.856)	4.28 (3.817)	6.74 (4.865)
	Above mean average	1.17 (1.978)	0.70 (1.330)	4.40 (3.880)	6.25 (4.773)
		p=0.176	p=0.069	p=0.793	p=0.387

DISCUSSION

High oral health literacy is associated with good oral health behaviors and dental status, defined as the number of decayed, missing and filled teeth. The present study indicates that most participants (54.7 percent) present with adequate oral health literacy, 38 percent marginal levels and 7.3 percent inadequate levels. A study published in 2007, using the REALD to evaluate oral health literacy levels performed in a private practice with adult patients, indicates 29 percent of participants presented with a low level of oral health literacy,[34] a lower value than that demonstrated in the present study, if we consider that marginal and inadequate levels correspond to a low level of oral health literacy.

The higher frequency of dentist visits reported by the participants is 2 to 4 times a year (46.7 percent), which is a higher value than reported by the Greek population in which 39.6 percent visited the dentist in the previous year,[35] a study performed in Turkey where 40.4 percent of participants visited the dentist in the previous year[36] and in a study in Australia where 34.3 percent of the participants visited the dentist in the previous year[37] or Malaysia with a 42.2 percent.[38] However, the results in this study are lower than those published in 2000 in Lithuania with 60 percent of participants visiting the dentist in the previous year,[39] nevertheless, if we consider the visits in the previous year, we can establish that 72.2 percent of this study participants visited the dentist, values that are higher than those presented in the above-mentioned studies.

The approach to low literacy level patients, not only oral communication should be used, but also written communication can, eventually, increase knowledge transmission,[40] a fact that has been shown in the present study by the low values obtained in the reading and comprehension components. Given this evidence the oral health information and care should be reinforced orally and by writing to assure full comprehension.

Dental health in young military adults has been studied for the past years, always with the purpose of understanding and labeling oral health in that population. Table 4 presents some studies published since 2000.

Table 4 Studies Published about Dental Caries Experience in Military Population

Authors	Year of study	Age/Age range	Sample	DMFT (mean)	Country
Sgan-Cohen et al.[41]	1994-1997	21	7139	8.5	Israel
Kelly et al.[42]	1998	16-24	491	1.6	United Kingdom
Gonçalves, Peres & Marcenes[43]	2002	18	300	4.6	Brazil
Samorodnitzky & Levin[44]	2005	21	393	6.2	Israel
Menghini et al.[45]	2006	20	606	3.56	Switzerland
Junior[46]	2009	22-34	182	10.68	Brazil
Mombiedro et al.[47]	2011	18-53	387	4.05	Spain
Jasmin et al.[48]	2011	20-50	300	8.0	Malaysia
Grewal et al.[49]	2013	20-34	270	2.2	India
Present study	2015	19-29	274	6.46	Portugal

In the present study the mean value of DMFT was 6.46, a value that when compared to other studies demonstrates the existing variability among different countries data and different periods, however, when compared to studies performed in the second decade of this century they present with a higher mean value.

In a study completed in Israel,[41] of a sample of 7139 21-year-old militaries, a mean DMFT of 8.49 was observed, the decayed component being 2.25. In the present study, the decayed component was 1.25 to a DMFT of 6.46; the previously mentioned component is lower than that in the study of Sgan-Cohen.[41]

The Adult Dental Health Survey carried out in the United Kingdom,[42] had a sample of individuals with an age range similar to the present study where it was possible to observe a mean value of DMFT of 1.6, lower than that observed in the present study (6.46), which could probably be explained by the fact that there are individuals with 16 to 18 years old, that have a lower exposition to the dental caries risk given that they are younger.

A Brazilian study,[43] about dental caries and socioeconomic status on 18-year-old individuals revealed a mean DMFT value of 4.5. This value also is lower than that observed in the present study, probably by the same reasons than those presented for the value observed in the above-mentioned English study.

A study presented in 2005,[44] with a sample of 393, 21-year-old, Israeli military (84 percent being masculine and 16 percent feminine) with a mean DMFT of 6.2, slightly lower than that observed in the present study when comparing the different components of the DMFT when can observe that the individuals of the present study present with a mean value of decayed teeth of 1.25, this value lower than that observed in Israeli individuals (2.06). In the missing teeth component, individuals in the present study present with a value of 0.87, this value higher than that of Israeli individuals (0.24). Regarding the filled teeth component, the present study individuals also present with a higher value than Israeli individuals, the values being 4.35 and 3.9, respectively. From this data, we can conclude that there is less dental caries, more missing teeth and a higher number of filled teeth in individuals of the present study when compared to Israeli individuals.

In a study made in 2009 in Brazil[46] with a sample of 182 individuals between the ages of 22 and 34, the mean value of DMFT was 10.68, which is a higher value than that of the present study (6.46).

A study carried out in Spain in 2011,[47] evaluated the dental caries prevalence in the Spanish military population of 294 participants, 213 males (72.4 percent) and 81 females (27.6 percent), with an age average of 23.7. The DMFT of the Spanish participants was 3.51, a considerably inferior value than that presented in the present study of 6.4, given that the decayed teeth presented with 0.92, 0.60 for the missing teeth and 1.98 for the filled teeth, compared to the present study where the value of decayed teeth is 1.25, 0.87 for the missing teeth and 4.35 for the filled teeth. This means that by comparison to the values of the Spanish participants, the participants of the present study presented with a higher DMFT value, the values of each component all being higher. It can also be stated that 23.8 percent of Spanish participants were free of carious lesions and that 44.6 percent presented with active carious lesions, data which contrasts with the higher percentage of Portuguese participants that is free of carious lesions (51 percent).

The same study mentioned above also evaluates DMFT by gender, and we can observe that masculine individual presented with a DMFT value of 3.67, 0.71 for the decayed component, 0.87 for the missing teeth component and 2.09 to the filled teeth component. We can also observe that 26.5 percent of this gender individuals were free of dental caries and 38.1 percent presented with active dental caries. Concerning the feminine individuals, the value of DMFT was 5.42, the values for dental caries, missing and filled teeth components being 1.05, 0.87 and 3.51, respectively. In the present study women also present with a value of DMFT higher than that of men (7.72 and 6.31) respectively, the filled teeth component having a significant portion in the DMFT value of both individuals' groups.

DMFT values are also divided into two categories those being individuals with less than 25 years old and those with 25 years old or more. In the group of individuals less than 25 years old the DMFT value was 2.66, with a dental caries component of 0.82, a missing teeth component of 0.32 and a filled teeth component of 1.52. In that group, 29.6 percent of individuals were free of dental caries and 41.9 percent presented with active caries. On the other hand, in the group of individuals with 25 years old or more the DMFT value was 5.34, with dental caries, missing and filled teeth component of 0.75, 1.38 and 3.21, respectively. The percentage of individuals free of dental caries is 16.9 percent, and those with active

dental caries is 38.3 percent. Comparing with the present study, we can verify that the DMFT values and the values for each component, for individuals with age inferior to 25 years, were higher than those related in the Spanish study.

Regarding the distribution of dental caries, in the present study, the teeth that presented with a higher prevalence of carious lesions were molars, which is also described in a study made in 2010 in the University of Istanbul.[50] More teeth were missing in the mandible than in the maxilla, which is different than that described in literature, such as in the study made in the USA between 1988 and 1991, where the higher number of missing teeth was observed in the maxilla.[51] In was also observed that the older the individuals, the higher the number of missing teeth and the higher the value of DMFT, such as what was concluded in the present study.

In the present study a higher number of filled teeth is associated with a higher frequency of dentist visits, the contrary was described in a study of 2003 where it was observed that individuals that did not seek dental treatments had a higher number of dental caries and missing teeth than filled teeth.[52]

We can also conclude that participants with a low literacy level consequently have worse oral health, as described by the study made in 2012 in the USA[53] and in Japan in 2013 the conclusion was that lower oral health literacy levels were related to worse oral health.[5] In this study, it is described that participants with lower oral health knowledge present with a higher DMFT value, just as it was portrayed in the 2007 study in the USA where participants with lower oral health knowledge levels presented with worse oral health.[34] However, even though the results found are similar to those described in the literature, in the present study the relationship between oral health literacy levels and DMFT index values did not have statistically significant results.

This work allowed to obtain the following information, the gender of the individual is not related to the oral health status assessed by the DMFT index with a value of p = 0.143. The age of the individual is related to the oral health status

evaluated by the DMFT index, and there is a statistically significant difference (p = 0.022) among the younger enlisted individuals (19 to 22 years) and the older ones (26 to 29 years). The educational level is not related to the oral health status evaluated by the DMFT index (p = 0.258). The frequency of visits to oral health professionals is related to the oral health status evaluated by the DMFT index, and this difference is statistically significant with p = 0.009 in the comparison of the mean DMFT value of those who visit the dentist only when they need it and those who visit the dentist two to four times a year and are also statistically significant (p = 0.007) among those who visit the dentist once a year and those who do it two to four times a year. There is no relationship between oral health literacy, years of education and oral health assessed by the DMFT index.

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