Global Journal of Medical Research: L
Nutrition & Food Science
Volume 24 Issue 1 Version 1.0 Year 2024
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Characterization and Analysis of Health Literacy and Adherence to the Mediterranean Dietary Pattern in Senior University Students

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GJMR-L Classification: *NLMC Code: W20.5*

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Joana Rodrigues [α], Madalena Azaruja [σ], Helena Loureiro [ρ] & João Paulo Figueiredo [ω]

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Materials and Methods: The study sample was constituted by 114 students registered in Portuguese Senior Universities, in the Central Zone and Metropolitan Area of Lisbon. Participants were aged between 54 and 88 years old, with 79 individuals being female and the remaining 35 male. It was applied to a sociodemographic questionnaire, the PREDIMED questionnaire, to assess adherence to the Mediterranean Dietary Pattern, and the HLS-EU-PT questionnaire to assess the level of health literacy. For statistical treatment, SPSS software version 27.0 was used.

Results: There were no significant results, however it was verified that most participants had a "problematic" level of Health Literacy and "low adherence" to the Mediterranean Dietary Pattern.

Conclusions: It is necessary to carry out more studies on this topic and more Health Education Programs, in order to highlight their needs and advantages, with the aim of promoting the population's health.

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I. Introduction

Health Literacy (HL) is defined by the World Health Organization (WHO) as the "set of cognitive and social skills and the person's ability to access, understand, evaluate and apply health information, in order to promote and maintain a good health"(1). It is already clear that a low HL is associated with worse health outcomes, particularly affecting minority populations, the elderly, people with a lower educational level and/or lower incomes. (2,3).

It is known that the Portuguese population is represented by a high percentage of elderly people, one of the groups with the lowest Health Literacy and worst health outcomes. From 2001 to the present (data from 2021), the age groups from 0 to 64 years old have decreased, while the group aged 65 and over has seen an increase of almost 4% (4.5). This aging pattern is common throughout Western Europe. In 2015, the growth of the age group of people aged 65 and over, in Portugal, ranked 10th, compared to other European countries. Projections predict that we will continue to see a clear worsening of the demographic aging process until 2080 (6). Therefore, working in this age group in Portugal becomes emerging, as it constitutes a considerably large and vulnerable group.

Despite the lack of attention given to this issue, UNESCO has already highlighted for about 30 years the importance of promoting educational and cultural activities for retired and/or elderly people, with the aim of ensuring them a better quality of life and also to ensure that societies benefit from their long experience. Local entities are therefore challenged to ensure the promotion of this type of activities for the senior population, in order to promote active ageing (6).

As nutrition is a crucial part of good health, it plays a decisive role in these results. Several studies have shown that there is a relationship between the Mediterranean Dietary Pattern and good health, since some components of this dietary pattern have been associated with a longer life expectancy and a lower incidence of chronic diseases. Thus, it has been possible to find an association between lower overall mortality and mortality from coronary heart disease and a longer life expectancy in Mediterranean countries (7).

These are two concepts of high importance and emergence of action, and the question also arises as to whether they are related in any way, since Health Literacy can influence health choices and habits, which may include food choices.

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a) *Background*

i. *Health Literacy*

The most recent data regarding HL in Portugal, obtained after the evaluation carried out by the General Directorate of Health, between 2020 and 2021, within the scope of the Action Plan for Health Literacy 2019-2021, and framed in the consortium European "WHO Action Network on Measuring Population and Organizational Health Literacy" (M-POHL), reveal that 65% of respondents had "Sufficient" knowledge and only 5% had an "Excellent" level. It was also possible to understand that 22% and 8% revealed "Problematic" and "Inadequate" levels, respectively. In general, and compared to other European countries, such as Germany, Spain or Greece, Portugal had relatively lower Health Literacy rates. (1.8). Through the "Synthesis Report - Health Literacy in Portugal" from the Calouste Gulbenkian Foundation, from 2016, it is possible to verify that individuals aged 66 or over represent a vulnerable group with regard to this topic (8).

Knowledge, motivation and personal skills are essential for a good understanding of information and consequently improving HL. In turn, the level of this knowledge will also determine access to healthcare (1). Social determinants such as ethnicity, socioeconomic level, gender differences, culture, language and even academic qualifications have an influence on the level of HL. Thus, individuals with a low socioeconomic level and a low level of education have lower health knowledge, which in turn limits participation in disease screening and generates less understanding of the information received about a disease and its respective treatment (9). Therefore, it is of great importance to measure HL levels in populations, in order to constitute a starting point for planning health interventions as well as to support policies aimed at the specific characteristics of the population and respective knowledge (1).

It is possible to assess the relationship between food choices, whether at an individual, community or global level, and factors such as social context, food availability, policy formulation, marketing strategies, food prices, and food literacy (FL) levels (10). It has been proven that adults with low LS have greater difficulty in understanding issues in the area of Nutrition, such as following nutritional recommendations from health professionals, reading food labels and thus making informed decisions when purchasing these products (9). According to the Global Burden of Disease study, in 2019, the eating habits of the Portuguese represented the fifth risk factor that most contributed to the loss of years of healthy life due to illness. This increase in food-related illnesses has been associated with poor eating habits and low levels of knowledge and skills related to food (10).

HL appears to be associated with eating behaviors, however, the relationships found between LS and dietary intake have been contradictory. According to the study by *Chari et al.* (2014), it was shown that parents with low literacy are more likely to promote obesogenic food environments. In a study that included hypertensive and diabetic patients, no relationships were found between HL and adherence to the Low Salt Diet or Macronutrient Restricted Diets, respectively. On the other hand, it was found, in another study, that lower quality diets and greater intake of sugary drinks were more prevalent in adults with low HL levels, establishing an association between the variables (2,11–14). In an investigation carried out on patients undergoing kidney transplantation, it was found that higher levels off FL were associated with higher scores on the Mediterranean Diet adherence questionnaire as well as with high scores in the three HL domains (15).

ii. *Mediterranean Dietary Pattern*

The "Mediterranean Diet" (MD) concept became known through the "Seven Countries Study", led by Ancel Keys between 1958 and 1964. In this study, eating habits were compared in different countries, namely in the United States of America (USA) , Japan, Finland, Netherlands, former Yugoslavia, Italy and Greece. In this way, it was possible to characterize this diet in relation to the foods that make up it, despite there not being a single MD, as the foods that make up this pattern vary between countries in the Mediterranean basin (7). Even so, in general, this dietary pattern is characterized by favoring the consumption of foods of plant origin, including a high amount of fruit and vegetables, whole grains, legumes, olive oil, oilseed fruits and a moderate intake of meat, fish and dairy products. Water is the main drink and wine should be consumed in moderation, only with main meals. This dietary pattern uses a healthy culinary base, using dishes cooked in water (soups, boiled, stews), preserving nutrients, and giving priority to fresh and seasonal products. Thus, it is a food model that promotes health and protects the environment and has been considered intangible cultural heritage of humanity since December 2013 (16,17).

In 2020, adherence to the MD was studied in Portugal, and it was found that 26% of the Portuguese population has "High Adherence" to the MD, which means that the percentage of "Low Adherence" is 74%. Therefore, the majority of Portuguese people do not follow this health-protective dietary pattern (17).

iii. *Portuguese Senior Population and Aging Process*

The aging process encompasses not only biological changes, but also social and psychological ones. Through the analysis of statistical data, relating to 2021, mentioned in the PORDATA database, it is possible to verify the increase in the Aging Index over the last few years, which translates into the number of

people aged 65 or over per 100 people under 15 years old. A value below 100 means that there are fewer elderly people than young people. In 2001, this index stood at 102.2, having increased to 182.1 in 2021. The longevity index has also been increasing, going from 39.3 to 47.9, respectively in the years mentioned. Thus, it is possible to witness an inversion of percentages in terms of the size of the senior population (individuals aged 65 or over), adults and young people, making the aging process a central problem in our societies, especially the more developed ones. Several challenges thus arise, encompassing social support structures, mainly in terms of health, pension and social security schemes and longevity, life trajectory and work (4–6).

In this light, Senior Universities have demonstrated an essential role in the acquisition and continuous updating of knowledge, improvement of skills and sharing of reflective and practical knowledge among the senior population (6).

iv. *Senior Universities*

The Senior Universities (SU) existing in Portugal differ from social centers and/or day centers in several aspects, being aimed at populations with different characteristics. In the SU, the population is physically and psychologically autonomous, showing some weakness in knowledge of new technologies, while in the centers, they present more physical and/or intellectual difficulties. However, aspects such as the creation of interpersonal relationships, socialization between peers, combating isolation and cognitive degeneration, are common aspects between both.

Due to the growing number of SU, in 2016, the need arose for official recognition through the creation of the Network of Senior Universities (NSU) as a representative entity for them, also holding the role of partner for the development of active aging policies and the social economy. (6.18).

SU students are mostly women (76%), aged between 60 and 70 years old, retired or domestic workers (80%) and with qualifications ranging from 4th class to PhD. At SU, courses are taught by specialists in different areas and most of the subjects taught are common to all Universities, including Sports, Arts, IT, Health and others (18).

II. Objectives

a) Main Objective

Check whether there is a relationship between the level of Health Literacy and the level of Adherence to the Mediterranean Dietary Pattern in students at Senior Universities.

b) Specific Objectives

Analyze the impact of socioeconomic factors on adherence to the Mediterranean Dietary Pattern and on Health Literacy levels of students at Senior Universities.

III. Material and Methods

a) Study Design

An analytical observational study was developed and, regarding the timeline, it is classified as cross-sectional. This was a level II correlational descriptive study.

b) Study Location

The development of the study was carried out in some Portuguese Senior Universities, namely the Senior University of Curia, the Senior University of Nelas, the Senior University of Gouveia, the Senior University Aposenior Coimbra and the Senior University D. Sancho I, in Almada.

c) Duration and Period of Study

The duration of the study covered the academic year 2021/2022 and regarding the study period (analytical collection), it took place between the months of March and May 2022, inclusive.

d) Target Population

This study encompasses any student enrolled in the selected Senior Universities, with a sample consisting of adults and elderly people. As for the inclusion criteria in the study, these were being registered as a student in one of the selected Senior Universities and presenting duly signed informed consent, with the lack of one of these defined as exclusion criteria.

e) Sample Size and Characterization

Of a total of 2462 students enrolled in the US covered in the study, responses were obtained from 114 students. These students range in age from 54 to 88 years old, with 79 individuals being female and the remaining 35 being male. The majority have Portuguese nationality, with only one individual with Angolan nationality. Regarding the area of residence, only the Center Regions and Metropolitan Area of Lisbon are covered.

f) Sampling type and Technique

The type of sampling applied was non-probabilistic and regarding the sampling technique, this was for convenience..

g) Data Collection Instruments

Study data was collected through questionnaires completed online or in person, depending on the University. The platform chosen to apply the questionnaire in an online format was Google Forms. In the first instance, the individual's willingness to participate in the study of their own free will, without any ethical or moral prejudice, was questioned. Data collection comprised three parts, obtaining sociodemographic data, applying the PREDIMED questionnaire and applying the HLS-EU-PT47 questionnaire.

i. *Sociodemographic Questionnaire*

With the aim of analyzing the sociodemographic data of the sample, a questionnaire was created, based on questionnaires used in other studies related to the theme of health literacy, in which the following parameters were collected: gender; date of birth; educational qualifications; nationality; residence zone; Senior University where he was enrolled (19,20).

ii. *Predimed questionnaire*

The instrument used to assess adherence to the Mediterranean Dietary Pattern was the PREDIMED questionnaire. This is a validated questionnaire for the Portuguese population consisting of 14 questions related to the consumption/frequency of consumption of various foods included and not included in this pattern. For each question, scoring criteria are defined, based on compliance or non-compliance with the MD principles. Thus, for data analysis, responses that meet the criteria are scored with one point and those that do not meet the criteria are not scored. In this way, a final score is obtained that corresponds to the sum of the scores of the 14 questions. This score can vary between 0 and 14 points, with adherence to the Mediterranean Dietary Pattern defined at two levels: low (< 10 points) and high (≥ 10 points) (17).

iii. *Hls-Eu-Pt47 Questionnaire*

The HLS-EU is an instrument to assess the level of Health Literacy by self-perception. This is a questionnaire with which, through a scale of four classifications (from "very difficult" to "very easy"), the participant indicates the degree of difficulty they feel in carrying out tasks relevant to individual health (19).

This instrument consists of 47 questions, grouped into three health domains ("Health Care", "Health Promotion" and "Disease Prevention") and four levels of information processing that influence decision-making (access, understanding, evaluation and use), which allows categorizing health literacy groups according to cutoff points. In order to guarantee the correct calculation of the indices and ensure comparison between them, the four calculated indices were organized on a scale from 0 to 50, in which 0 is the minimum possible Health Literacy and 50 is the maximum. Next, the following cutoff points are identified for the four levels: scores equal to or less than 25 points = Inadequate Health Literacy; scores between 25-33 points = Problematic Health Literacy; scores between 33-42 = Sufficient Health Literacy; and scores between 42-50 = Excellent Health Literacy (19).

It should be noted that only questionnaires with more than 80% of the items answered with specific indices (1 to 4 values) are considered valid (21).

This questionnaire has already been validated for the Portuguese population, with the original 47 questions being maintained, meaning that the HLS-EU-PT is similar in terms of psychometric properties to the original scale. Therefore, it is an instrument that is suitable for analyzing the level of Health Literacy in the Portuguese population.

h) Ethical Issues

All phases of the study respected the required ethical rigor to the maximum. The sources used as theoretical support were duly identified and referenced, respecting the rights of each author.

With regard to data collection, participants were previously informed about the objectives and methodology of the investigation, about the information to be collected and the purposes for which it would be used, as well as the methods of processing the information in order to guarantee the confidentiality and anonymity of data. Thus, participation in this research was part of a conscious decision-making process on the part of each individual, through the signing of informed, free and clarified consent, also having the possibility of refusing to participate without any prejudice, safeguarding the interests and rights of each participant

Finally, formal emails were sent to the management of the Senior Universities requesting collaboration in the research, informed, free and informed consent documents were distributed to all participants and a favorable ethical opinion was also obtained from the Ethics Committee of the Polytechnic Institute of Coimbra (ECPIC).

IV. Statistical Analysis

To perform the statistical analysis, the statistical software IBM SPSS Statistics version 27.0 was used.

In an initial phase, the HLS-EU-PT47 scores were calculated, through data processing and calculation of scores using the formula, in order to proceed with the classification (22).

For descriptive statistics, measures of central tendency (mean and median) and measures of dispersion (standard deviation, minimum and maximum) were determined in relation to age, responses to the PREDIMED questionnaire and other sociodemographic variables.

Subsequently, at the level of hypotheses, the Chi-Square test, Student's t-test and the Kruskal-Wallis test were applied. For statistical inference, a confidence level of 95% was assumed for a maximum random error of up to 5%.

V. Results

The final sample was made up of 114 students, who completed all the questionnaires. However, it should be noted that, regarding the HLS-EU-PT47 questionnaire, eight of them were excluded because they did not meet the criteria for validation of this questionnaire (more than 80% of the questions answered with an exact answer).

In table 1 it is possible to characterize the sample in relation to Literary Qualifications. Thus, it was found that 22.8% of the participants had Basic Education (n=26), 23.7% had Secondary Education (n=27), and 42.9% of the participants had completed some degree of Higher Education (n =49). The most prevalent level of Literary Qualification in females was Bachelor's Degree, with 43%, and in males, Secondary Education was prevalent in 34.3% of participants.

Table 1: Characterization of the Sample Regarding Literary Qualifications

Literary Qualifications		Gender		Total
		Female	Male	
Basic Education	n (%)	18 (69.2%)	8 (30.8%)	26
	% column	22.8%	22.9%	22.8%
Secondary Education	n (%)	15 (55.6%)	12 (44.4%)	27
	% column	19%	34.3%	23.7%
Non-Higher Professional Qualification	n (%)	5 (41.7%)	7 (58.3%)	12
	% column	6.3%	20%	10.5%
Bachelor`s Degree	n (%)	34 (85%)	6 (15%)	40
	% column	43%	17.1%	35%
Postgraduate	n (%)	3 (75%)	1 (25%)	4
	% column	3.8%	2.9%	3.5%
Master's degree	n (%)	4 (80%)	1 (20%)	5
	% column	5.1%	2.9%	4.4%
Total	n (%)	79 (69.3%)	35 (30.7%)	114
	% column	100%	100%	100%

With regard to the Residence Area, it can be seen in table 2 that the sample was characterized by containing 25.4% of participants residing in the Lisbon Metropolitan Area (LMA) (n=29), 58.6% female (n=17). The remaining 74.6% of participants lived in the Central area, with 72.9% being women (n=62).

Table 2: Characterization of the Sample According to Area of Residence and Age

Residence Zone		Gender		Total
		Female	Male	
Lisbon Metropolitan Area	n (%)	17 (58.6%)	12 (41.4%)	29
	% column	21.5%	34.3%	25.4%
Center	n (%)	62 (72.9%)	23 (27.1%)	85
	% column	78.5%	65.7%	74.6%
Total	n (%)	79 (69.3%)	35 (30.7%)	114
	% column	100%	100%	100%
Age	M ± SD	68.81 ± 6.35	71.4 ± 6.61	69.62 ± 6.51

Legend: M = Mean; SD = Standard Deviation

The average age of the participants was 69.62 years, with the average age of females being slightly lower than that of males, 68.81 years and 71.40 years, respectively (table 2).

In table 3, it is observed that there were no significant differences in the HLS classification depending on age (p>0.05). Even so, it was found that the highest average age, 70.73 years, was more associated with the “Problematic” classification level.

Table 3: Differences in Classification in *HLS-EU-PT Depending on Age*

	HLS classification				Total	*p*
	Inappropriate	Problematic	Enough	Excellent		
n	12	62	25	5	104	0.226
M ± DV	67.17 ± 6.013	70.73 ± 5.848	69.16 ± 8.697	68.00±4,899	69.81 ± 6.652	

Legend: M = Average; SD =Standard Deviation; TestKruskal-Wallis (Significant correlation when p≤ 0.05)

There were no significant differences in the classification obtained in the HLS-EU-PT questionnaire depending on gender ($p>0.05$). Even so, it was possible to verify that the most common classification in both genders was "Problematic". It is also concluded that the "excellent" classification was the least prevalent in both genders (table 4).

Table 4: Differences in Classification in *HLS-EU-PT as a Function of Gender*

			Gender		Total	*p*
			Female	Male		
HLS Classification	Inappropriate	n (%)	11 (84.6%)	2 (15.4%)	13	0.511
		% column	14.9%	6.3%	12.3%	
	Problematic	n (%)	41 (66.1%)	21 (33.9%)	62	
		% column	55.4%	65.6%	58.5%	
	Enough	n (%)	17 (68.0%)	8 (32.0%)	25	
		% column	23.0%	25.0%	23.6%	
	Excellent	n (%)	5 (83.3%)	1 (16.7%)	6	
		% column	6.8%	3.1%	5.7%	
Total		n (%)	74 (69.8%)	32 (30.2%)	106	
		% column	100.0%	100.0%	100.0%	

Caption: Test Chi-Square of Independence (Significant correlation when $p \leq 0.05$)

As can be seen in table 5, the classifications of "Inadequate", "Problematic" and "Sufficient" regarding the level of health literacy were higher in the central zone than in the LMA. This condition only did not occur in the "excellent" classification, in which identical percentages were obtained for both areas. The results were not significant ($p>0.05$).

Table 5: Differences in Classification in *HLS-EU-PT Depending on the Area of Rresidence*

			Residence Zone		Total	*p*
			LMA	Center		
HLS Classification	Inappropriate	n (%)	2 (15.4%)	11 (84.6%)	13	0.462
		% column	7.1%	14.1%	12.3%	
	Problematic	n (%)	16 (25.8%)	46 (74.2%)	62	
		% column	57.1%	59.0%	58.5%	
	Enough	n (%)	7 (28.0%)	18 (72.0%)	25	
		% column	25.0%	23.1%	23.6%	
	Excellent	n (%)	3 (50.0%)	3 (50.0%)	6	
		% column	10.7%	3.8%	5.7%	
Total		n (%)	28 (26.4%)	78 (73.6%)	106	
		% column	100.0%	100.0%	100.0%	

Caption: Test Chi-Square of Independence (Significant Correlation when $p \leq 0.05$); AML - Lisbon Metropolitan Area

Next, the relationship between Literary Qualifications and the classification of the HLS questionnaire was evaluated (Table 6). It was found that there were no significant differences between the two ($p>0.05$). Even so, it was possible to verify that the majority of participants have a "problematic" level of HL. In all educational qualifications, the classification with the lowest prevalence was the "excellent" level, except in Higher Education, in which the "inadequate" level had the lowest prevalence.

It should be noted that at all levels of educational qualifications, the majority of literacy levels were classified as "Problematic".

Table 6: Differences in Classification in *HLS-EU-PT According to Academic Qualifications*

			HLS classification				Total	*p*
			Inappropriate	Problematic	Enough	Excellent		
Literary Qualifications	Basic Education	n (%)	4 (16.7%)	12 (50.0%)	8 (33.3%)	0	24	0.559
		% column	30.8%	19.4%	32.0%	0.0%	22.6%	
	Secondary Education	n (%)	4 (16.7%)	15 (62.5%)	4 (16.7%)	1 (4.2%)	24	
		% column	30.8%	24.2%	16.0%	16.7%	22.6%	
	Qualification NHP	n (%)	1 (8.3%)	8 (66.7%)	3 (25.0%)	0	12	
		% column	7.7%	12.9%	12.0%	0.0%	11.3%	
	Higher education	n (%)	4 (8.7%)	27 (58.7%)	10 (21.7%)	5 (10.9%)	46	
		% column	30.8%	43.5%	40.0%	83.3%	43.4%	
Total		n (%)	13 (12.3%)	62 (58.5%)	25 (23.6%)	6 (5.7%)	106	
		% column	100.0%	100.0%	100.0%	100.0%	100.0%	

Caption: Test Chi-Square of Independence; (Significant Correlation when p≤ 0.05); NHP – Non-Higher Professional

Analyzing the relationship between age and the classification obtained in PREDIMED (Table 7) it is clear that there were no significant differences (p>0.05). The average age of participants with "high adherence to MD" was slightly lower than that of those who revealed "low adherence", with respective values of around 68 and 70 years.

Table 7: Differences in Classification in *PREDIMED Depending on Age*

	PREDIMED Classification	N	M ± DV	*p*
Age	Low adherence	70	70.39± 6.636	0.107
	High adhesion	42	68.33± 6.167	

Legend: M = Average; SD =Standard Deviation; t-Student test (Significant Correlation when p≤ 0.05)

There were no significant differences in the classification obtained in PREDIMED depending on gender, however, it was observed that in both genders there was a higher percentage of "low adherence", this being higher in men than in women, with 71.4 % and 58.2%, respectively (Table 8).

Table 8: Differences in Classification in *PREDIMED as a Function of Gender*

			PREDIMED Classification		Total	*p*
			Low Adherence	High Adhesion		
Gender	Female	n (%)	46 (58.2%)	33 (41.8%)	79	0.180
		% column	64.8%	76.7%	69.3%	
	Male	n (%)	25 (71.4%)	10 (28.6%)	35	
		% column	35.2%	23.3%	30.7%	
Total		n (%)	71 (62.3%)	43 (37.7%)	114	
		% column	100.0%	100.0%	100.0%	

Caption: Test Chi-Square of Independence; (Significant correlation when p≤ 0.05)

Now evaluating the relationship between the classification obtained in PREDIMED and the area of residence (Table 9), it was concluded that there were no significant differences (p>0.05). It can be seen, however, that the prevalence of low adherence was higher in the center compared to the metropolitan area of Lisbon, with values of 78.9% and 21.1%, respectively. It is also noticeable that in the Lisbon metropolitan area there was a slightly disparate distribution of "high" and "low" adherence, with the percentage of low adherence being slightly higher. In the Center area, the percentage of low adherence was considerably higher than that of high adherence, with 65.9% and 34.1%, respectively.

Table 9: Differences in Classification in PREDIMED Depending on the Area of Residence

			PREDIMED Classification		Total	*p*
			Low adherence	High adhesion		
Residence zone	Lisbon Metropolitan Area	n (%)	15 (51.7%)	14 (48.3%)	29	0.174
		% column	21.1%	32.6%	25.4%	
	Center	n (%)	56 (65.9%)	29 (34.1%)	85	
		% column	78.9%	67.4%	74.6%	
Total		n (%)	71 (62.3%)	43 (37.7%)	114	
		% column	100%	100.0%	100.0%	

Caption: Test Chi-Square of Independence; (Significant Correlation when p≤ 0.05)

Next, the level of Literary Qualifications was compared with the Classification obtained in PREDIMED (Table 10). The results obtained were not significant (p>0.05). Even so, it was possible to verify that, in all levels of Literary Qualifications, the majority of participants presented "low adherence" to the Mediterranean Dietary Pattern. It should be noted that the highest percentage of "low adherence" was found in "Basic Education" (76.9%) and the lowest in "Higher Education" (55.1%).

Table 10: Differences in Classification in *PREDIMED Depending on Literary Qualifications*

			PREDIMED Classification		Total	*p*
			Low adherence	High adhesion		
Literary Qualifications	Basic Education	n (%)	20 (76.9%)	6 (23.1%)	26	0.302
		% column	28.2%	14.0%	22.8%	
	Secondary Education	n (%)	16 (59.3%)	11 (40.7%)	27	
		% column	22.5%	25.6%	23.7%	
	Non-higher professional qualification	n (%)	8 (66.7%)	4 (33.3%)	12	
		% column	11.3%	9.3%	10.5%	
	Higher education	n (%)	27 (55.1%)	22 (44.9%)	49	
		% column	38.0%	51.2%	43.0%	
Total		n (%)	71 (62.3%)	43 (37.7%)	114	
		% column	100%	100.0%	100.0%	

Caption: Test Chi-Square of Independence; (Significant Correlation when p≤ 0.05)

With the data presented in table 11, it was possible to verify that although the entire sample uses olive oil as the main source of fat for cooking, the majority (77.4%) consumes less than 4 tablespoons per day.

It was also found that 71.7% of respondents consumed more than two portions of vegetables per day. Regarding the consumption of fruit and legumes, most of the sample (59.4% and 50.9%, respectively) revealed that they consumed more than 3 portions of these foods per day.

It was also noticeable that the majority of the sample consumed fish or seafood more than 3 times a week and that more than 70% preferred white meat to red meat, with 67% saying they consumed less than one portion of red meat, hamburger or derivatives, per day.

With regard to cooking methods, it was found that 66% of participants consumed meals cooked with a base of tomato, onion, garlic and olive oil more than twice a week.

Regarding the consumption of more sugary foods, the majority of respondents responded that they drank soft drinks less than once a day (87.7%) and consumed sweet desserts, cookies and cakes less than 3 times a week (68.9%).

In the case of portions of oilseed fruits per week, 50.9% said they consumed less than 3 portions.

Table 11: Relationship between the Answers Obtained in the *PREDIMED and Classification in HLS-EU-PT47*

			HLS classification				
			Inappropriate	Problematic	Enough	Excellent	Total (% column)
How many tablespoons of olive oil do you consume per day?	<4	n (%)	11 (13.4%)	47 (57.3%)	19 (23.2%)	5 (6.1%)	82 (77.4%)
	>=4	n (%)	2 (8.3%)	15 (62.5%)	6 (25.0%)	1 (4.2%)	24 (22.5%)
How many servings of vegetables do I consume per day?	>=2	n (%)	7 (9.2%)	46 (60.5%)	19 (25.0%)	4 (5.3%)	76 (71.7%)
	>=2	n (%)	7 (9.2%)	46 (60.5%)	19 (25.0%)	4 (5.3%)	76 (71.7%)
How many servings of fruit do you consume per day?	<3	n (%)	4 (9.3%)	21 (48.8%)	15 (34.9%)	3 (7.0%)	43 (40.6%)
	>=3	n (%)	9 (14.3%)	41 (65.1%)	10 (15.9%)	3 (4.8%)	63 (59.4%)
How many servings of red meat, hamburgers or derivatives do you consume per day?	>=1	n (%)	4 (11.4%)	25 (71.4%)	6 (17.1%)	0	35 (33.0%)
	<1	n (%)	9 (12.7%)	37 (52.1%)	19 (26.8%)	6 (8.5%)	71 (67.0%)
How many sugary soft drinks do you consume per day?	>=1	n (%)	1 (7.7%)	9 (69.2%)	3 (23.1%)	0	13 (12.3%)
	<1	n (%)	12 (12.9%)	53 (57.0%)	22 (23.7%)	6 (6.5%)	93 (87.7%)
How many servings of legumes do you consume per week?	<3	n (%)	9 (17.3%)	27 (51.9%)	14 (26.9%)	2 (3.8%)	52 (49.1%)
	>=3	n (%)	4 (7.4%)	35 (64.8%)	11 (20.4%)	4 (7.4%)	54 (50.9%)
How many servings of fish or seafood do you consume per week?	<3	n (%)	5 (13.9%)	21 (58.3%)	8 (22.2%)	2 (5.6%)	36 (34.0%)
	>=3	n (%)	8 (11.4%)	41 (58.6%)	17 (24.3%)	4 (5.7%)	70 (66.0%)
How many times a week do you eat sweet desserts, cookies and cakes?	>=3	n (%)	2 (6.1%)	21 (63.6%)	10 (30.3%)	0	33 (31.1%)
	<3	n (%)	11 (15.1%)	41 (56.2%)	15 (20.5%)	6 (8.2%)	73 (68.9%)
How many servings of oilseed fruits (walnuts, hazelnuts, almonds, peanuts, etc.) do you consume per week?	<3	n (%)	7 (13.0%)	31 (57.4%)	15 (27.8%)	1 (1.9%)	54 (50.9%)
	>=3	n (%)	6 (11.5%)	31 (59.6%)	10 (19.2%)	5 (9.6%)	52 (49.1%)
Do you prefer to consume turkey, chicken, rabbit, or a vegetable alternative, rather than pork or beef?	No	n (%)	2 (9.1%)	14 (63.6%)	5 (22.7%)	1 (4.5%)	22 (20.8%)
	Yes	n (%)	11 (13.1%)	48 (57.1%)	20 (23.8%)	5 (6.0%)	84 (79.2%)
How many times a week do you eat meals cooked with tomatoes/tomato sauce, onion, garlic and olive oil?	<2	n (%)	2 (5.6%)	21 (58.3%)	11 (30.6%)	2 (5.6%)	36 (34.0%)
	>=2	n (%)	11 (15.7%)	41 (58.6%)	14 (20.0%)	4 (5.7%)	70 (66.0%)

Next, we attempted to relate the classification obtained in the HLS questionnaire with the classification in the PREDIMED questionnaire (Table 12). Thus, it was concluded that the majority of respondents have a "problematic" level of health literacy (58.5%) and revealed "low adherence" to MD (66%).

It was found that participants with "inadequate", "problematic" and "sufficient" health literacy levels were mainly associated with "low adherence" to the Mediterranean dietary pattern, with the percentages of low adherence being 69.2%, 66, 1% and 68%, respectively.

It was also understood that participants with the lowest level of health literacy had the lowest percentage of "high adherence" to MD. Only among participants with an "excellent" level of health literacy was there a considerable increase in the percentage of "high

adherence" to the Mediterranean Dietary Pattern, with a result of 50% being obtained. Even so, the results were not significant with regard to the PREDIMED classification depending on the HLS-EU-PT classification ($p>0.05$).

Table 12: Differences in the Classification in the PREDIMED Questionnaire Depending on the Classification in the HLS-EU-PT Questionnaire

			PREDIMED Classification		Total	*p*
			Low adherence	High adhesion		
HLS classification	Inappropriate	n (%)	9 (69.2%)	4 (30.8%)	13	0.852
		% column	12.9%	11.1%	12.3%	
	Problematic	n (%)	41 (66.1%)	21 (33.9%)	62	
		% column	58.6%	58.3%	58.5%	
	Enough	n (%)	17 (68.0%)	8 (32.0%)	25	
		% column	24.3%	22.2%	23.6%	
	Excellent	n (%)	3 (50.0%)	3 (50.0%)	6	
		% column	4.3%	8.3%	5.7%	
Total		n (%)	70 (66.0%)	36 (34.0%)	106	
		% column	100%	100.0%	100%	

Test Chi-Square of Independence; (Significant Correlation when p≤ 0.05)

The question coded as HLSQ38 corresponded to the question "Understanding the information on food packaging?". Even though the differences are not significant ($p>0.05$), the results presented in table 10 show that the majority of respondents who classified the HLSQ38 as "very difficult", "difficult" or "easy" had low adherence to MD, with 75%, 73.2% and 58.5%, respectively. The percentages of low and high adherence were only equal when they were associated with a "very easy" rating on question 38.

Table 13: Differences in the Classification of Question 38 of the HLS-EU-PT Depending on the PREDIMED Classification

			PREDIMED Classification		Total	p
			Low adherence	High adhesion		
HLSQ38	Very difficult	n (%)	3 (75.0%)	1 (25.0%)	4	0.333
		% column	4.3%	2.5%	3.6%	
	Difficult	n (%)	30 (73.2%)	11 (26.8%)	41	
		% column	42.9%	27.5%	37.3%	
	Easy	n (%)	31 (58.5%)	22 (41.5%)	53	
		% column	44.3%	55.0%	48.2%	
	Very easy	n (%)	6 (50.0%)	6 (50.0%)	12	
		% column	8.6%	15.0%	10.9%	
Total		n (%)	70 (63.6%)	40 (36.4%)	110	
		% column	100.0%	100.0%	100.0%	

Test Chi-Square of Independence; (Significant Correlation when p≤ 0.05)

VI. Discussion and Critical Analysis

Between 2020 and 2021, the General Health Direction (GHD) carried out an assessment of the Health Literacy of the Portuguese population, those over 16 years of age, and the "Health Literacy Survey" document referring to the data obtained was published. In this GHD assessment, it was found that there was a greater proportion of Portuguese with high levels of literacy, corresponding to the "Sufficient" or "Excellent" level, than with low levels, that is, "Problematic" or "Inadequate" level, having the majority (65%) obtained a "Sufficient" rating.

In contrast, in the sample of the present study, it was found that the majority (58.5%) had a "Problematic" level of HL, considered low. It should also be noted that in the aforementioned document only 7.5% presented the lowest level of health literacy ("Inadequate"), while in this study this level was presented by 12.3%. This divergence in results may be justified by the fact that the present study included mostly elderly people, one of the most vulnerable age groups with regard to HL knowledge and with a greater probability of obtaining a classification of "Inadequate" or "Problematic" in the HL level, as demonstrated in two studies by *Espanha et al.*(8.23). Even so, the percentage of low levels of health literacy obtained in the present study was 70.8%, lower than that obtained by *Araújo, et al.* in the study carried out in 2018, 80%(24).

Also in the "Health Literacy Survey", HL levels were analyzed considering sociodemographic data, namely Gender, Age and Education. No association was found with Gender, however, it was found that LS levels were associated with Age and Education, with an increase in low LS levels being revealed as the age group increased and education decreased.(1). Also *Spain et al.* , *Araújo et al. and Luís L.* demonstrated that higher levels of education and younger age groups were associated with higher levels of LS(8.23–25). On the contrary, in the present study, no significant associations were found between the LS variable and the factors Gender, Age and Educational Qualifications. Even so, in relation to Literary Qualifications, it was observed that the least predominant classification was "Excellent" at all levels of education except for those with Higher Education, whose lowest prevalence of classification was the "Inadequate" level, which seems to be in line with according to the results of the aforementioned study.

Regarding the analysis of Adherence to MD, in the present study, the majority of participants reveal that they have a "Low Adherence" to MD, this percentage being 62.3%, which is in line with the results of *Spinelli*'s study, carried out on the population elderly woman from the Algarve region, in which a percentage of "Low Adherence" to MD was also demonstrated (71%) higher than that of "High Adherence"(20). The same can be seen when comparing with the "Mediterranean Food Pattern Adherence Study", carried out by the GHD for the Portuguese population over 16 years old, in 2020, in which the "Low Adherence" rate is stood at 74% (17). According to the study by *Zaragoza Martí et al.,* carried out in a senior population in Spain in 2015, the percentage of "Low Adherence" to MD was 51.7%, demonstrating better adherence compared to current values, which may mean temporal evolution or cultural variation (26).

The GHD study also concluded that age appears to influence adherence to the Mediterranean Dietary Pattern (MDP), with the elderly age group having the lowest percentage of adherence, at just 19%, compared to 33% in the 16 to 34 age group. In this study, the percentage of individuals adhering to the MDP was higher, around 37.7%, which may be related to the fact that the sample included in this study was inserted in a very specific context (17).

Regarding the relationship between Adherence to MD and Gender, in the study by *Zaragoza Martí et al.,* no significant differences were identified between different genders, similar to the present study.(26). In Spinelli's study, the percentage of "Low Adherence" was focused on the Female gender, contrasting with the data from the "Study of Adherence to the Mediterranean Diet", in which men presented the lowest percentage of "High Adherence" (17.20).

According to *Gregório et al.,* it was concluded that individuals with higher education had better levels of adherence to MD, since the percentage of "High Adherence" was 11% higher in individuals with "more than the 12th grade"(17). Also in *Spinelli*'s study, lower adherence was found among respondents with lower levels of education.(20). In the present study, there are no significant differences, although it was found that the highest prevalence of "low adherence" occurred at the lowest level of education (basic education), contrasting with the highest percentage of "high adherence", obtained at the highest level. of Qualifications (Higher Education), which seems to be in line with what is described in the literature.

Similar to what was found in the study carried out in the Algarve, despite the fact that a large proportion of respondents showed low adherence to MD, the responses obtained in PREDIMED were relatively satisfactory (20). The entire sample in the present study reported using olive oil as their main fat, in line with the literature that reports percentages in the order of 90%, and the majority complies with the recommendations regarding the consumption of vegetables, fruit and legumes (20.26). Despite the primacy of olive oil for culinary uses, the majority of respondents responded that they consume less than 4 tablespoons per day, which may be indicative of difficulties in controlling food portions. Additionally, the majority of the population does not measure the exact amount of fat they use, and it is likely that their perception of the amounts used is not correct.

When comparing the results obtained with the recommendations for fruit and vegetable intake, it is possible to state that the percentage of adequacy was higher in this study compared to the GHD study. While, in the general population, a percentage of 39% of adequate fruit consumption was found, in the population of Senior Universities, the value rises to 59.4%. The same occurred in the case of vegetables, with an even greater discrepancy in values (17). These results may be a reflection of the fact that most of the participants in this study live in rural areas and have their own crops.

Regarding the adequate consumption of fish and seafood, it was found to be complied with by 66% of the sample in this study, slightly below the 74% obtained in the study carried out in the elderly population of the Algarve (20). These results may be inherent to the difference in accessibility of these foods in coastal and inland areas. Spinelli also demonstrated, in 93% of respondents, a preference for white meat over red meat, a value higher than that obtained in the present study (70%) (20).

In relation to sugary foods, there was a preference for the consumption of sweet desserts, cookies and cakes compared to the consumption of soft drinks, which may be related to the fact that soft drinks gained a greater impact on the market after the

existence of other products. It was also found that of the individuals with an "excellent" HL level, none reported an inadequate consumption of soft drinks and desserts, sweets, cookies and cakes. These data seem to be in line with those found in the systematic review by *Alessandra Buja et al.* , in which it was found that three studies associated higher HL levels with lower sugar consumption (27).

Regarding understanding the information contained on food packaging, despite there being no direct relationship with adherence to the MD, it was observed that individuals with high adherence classify this task less often as "very difficult" or "difficult". Even so, 40.9% of the sample revealed difficulties, a figure that could be higher in reality, as it was not determined whether the interpretation of each piece of information would be correct.

Still regarding the relationship between adherence to the MDP and the level of HL, it should be noted that, despite being independent of the "HLS classification" factor, there was a trend in the results, since the highest percentage of "low adherence" was associated with the lowest level of literacy. These results seem to indicate that, by increasing the levels of HL, the levels of adherence to the MDP would also increase, thus deducing the relevance of training interventions in this area, since it has already been demonstrated by *Kazuki Uemura et al.* that constant learning in the senior population promotes the improvement of HL and eating habits.(28).

VII. Study Limitations

With the development of the investigation, several limitations emerged that influenced the collection of data as well as the results, and must be taken into consideration when interpreting the data presented. One of the limitations was the sample size, as there was low student adherence, which resulted in a reduced number of participants compared to expected, not being enough to obtain conclusions similar to those obtained if the entire target population participated. Therefore, it is not possible to extrapolate this data to the generality, as this data constitutes only a characterization of the reality of the participating students.

Another limitation is the ability to understand and correctly interpret the questionnaires applied, which may have been distorted in some cases, especially in the online version of the questionnaires. In future studies, we propose the evaluation of other variables that could influence adherence to the Mediterranean dietary pattern, such as family income, household size, marital status, among others.

VIII. Conclusion

It can be concluded that the results obtained in this study were not statistically significant, which can be explained, in general, by the fact that both the level of Health Literacy and Adherence to the MDP constitute variables influenced by several factors, which can be complex interconnect them in a "cause-effect" relationship. Even so, it was possible to verify that the sample, in general, had lower than desirable levels of Health Literacy, as well as low adherence to the MDP. These results may constitute a vulnerability for the health status of the individuals surveyed, since low HL translates into insufficient knowledge and skills to prevent disease and improve health status, thus influencing food choices.

There is a clear need for more health education programs, designed to respond to the specificities of each population and age group, in order to fill the gaps previously described. As eating habits are decisive for a good state of health, the Nutritionist plays an important role in promoting their improvement and adequacy. This type of interventions plays a beneficial role at the individual level, but also in a comprehensive way, for the general population, since populations with higher levels of HL are associated with better health states and, consequently, less impact on this resources. sector in question.

The measurement of the levels of the variables mentioned above must be carried out regularly, as they undergo constant changes and, in this sense, this study could contribute to the knowledge of the "state of play" in this population, functioning as a starting point for possible training interventions on topics specific, adapted to the needs of the population studied.

It is also concluded that it would be beneficial to carry out more studies in this area, with greater methodological robustness, particularly at national level, with a larger and more heterogeneous sample, with the aim of keeping this topic in the focus of political decision-makers as a priority action.

List of Abbreviations

ECPIC - Ethics Committee of the Polytechnic Institute of Coimbra;

GHD - General Health Direction;

MD - Mediterranean Diet

MDP - Mediterranean Dietary Pattern;

HLS-EU-PT47 - Health Literacy Scale-European-Portugal 47 questions;

M-POHL - Measuring Population and Organizational Health Literacy;

FL - Food Literacy;

HL - Health Literacy;

NSU - Network of Senior Universities;

UNESCO - United Nations Educational, Scientific and Cultural Organization;

SU - Senior Universities;

WHO - World Health Organization.

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