NOVA IMS Information Management School

MEGI

Master Degree Program in

Statistics and Information Management

Health Literacy among Higher Education Students, its Relationship with Tobacco Consumption and Sleep Quality

Samira Almeida Carvalho de Boa Esperança

Master Thesis

presented as partial requirement for obtaining the Master's Degree in Statistics and Information Management

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

NOVA Information Management School

Instituto Superior de Estatística e Gestão de Informação

Universidade Nova de Lisboa

Health Literacy among Higher Education Students, its Relationship with Tobacco Consumption and Sleep Quality

by

Samira Almeida Carvalho de Boa Esperança

Master Thesis presented as partial requirement for obtaining the Master's degree in Statistics and Information Management, with a specialization in Risk Analysis and Management

Supervised by

Sara Alexandra da Fonseca Marques Simões Dias, PhD, Polytechnic Institute of Leiria

February, 2025

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

[Lisbon, February 2025]

Samira Esperança

ACKNOWLEDGEMENTS

First of all, I would like to thank God for all my achievements and for always giving me the strength to face every obstacle.

I would also like to take this opportunity to thank my supervisor, Professor Sara Dias, for her conditional support, guidance and patience. For all the moments of sharing knowledge and for always being available to help me.

I would also like to thank my dear boyfriend, Melven, who has always supported and encouraged me throughout my journey. On the days when I felt less motivated, it was he who gave me the courage to never give up, and on the days of greater inspiration, it was also he who provided me with even more strength to continue. Thank you, Melven, for being there whenever I needed you and for always showing me the right way forward.

To my dear parents, a special thank you for always being by my side over the years, both in my struggles and in my achievements, and for doing the impossible to make me the Woman I am today. Thank you for being such an inspiration to me!

Lastly, to all my other family members, friends, colleagues and people who have supported me in some way during this phase of my life thank you for your words of encouragement, support and sharing.

ABSTRACT

Health literacy has gained significant importance and prominence over the years. Higher education students go through a period of transaction, during which they are exposed to certain circumstances and risks that can unconsciously lead them to adopt consumption habits and behaviors that are very harmful to their health. Smoking, in both its traditional or electronic form and unhealthy sleep patterns are examples of these habits. Keeping this in mind, this study analyzes the relationship between health literacy, tobacco consumption, and sleep quality. It focuses on understanding how health literacy can influence tobacco consumption and sleep quality among higher education students. Measurement tools were used to assess health literacy, nicotine dependence related to tobacco consumption, and sleep quality among these students, specifically the Health Literacy Survey Questionnaire (HLS_{19}-Q12), the Fagerström Test for Nicotine Dependence (FTND), and the Pittsburgh Sleep Quality Index (PSQI), respectively. The main conclusions of this study highlight that tobacco consumption is negatively correlated with sleep quality, while an increase in health literacy is associated with a reduction in tobacco consumption and an improvement in sleep quality among higher education students.

KEYWORDS

Health Literacy; Higher Education Students; Sleep Quality; Tobacco Consumption

Sustainable Development Goals (SDG):

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

DGES	Directorate-General for Higher Education
FTND	Fagerström Test for Nicotine Dependence
HL	Health Literacy
HLS-EU	European Health Literacy Survey
HLS_{19}-Q12	Health Literacy Survey Questionnaire
NCDs	Chronic Non-Communicable Diseases
PhD	Doctor of Philosophy
PSQI	Pittsburgh Sleep Quality Index
SD	Standard Deviation
WHO	World Health Organisation

1. INTRODUCTION

The prevalence of low health literacy levels remains a significant concern (Espanha et al., 2015), even though the topic has become increasingly relevant over the years (Sørensen et al., 2012). Given the benefits that higher levels of health literacy can bring to people's lives, it is extremely important that this topic is increasingly addressed and understood (Nutbeam, 2000).

Entering higher education is a period surrounded by many challenges (Rababah et al., 2019). For some students, it is a time that brings a lot of stress and anxiety due to the pressure to achieve specific goals and the need to fit into society (Alves et al., 2021). It also marks a crucial transition to adulthood, which generally requires a higher level of autonomy, responsibility, independence, and balance between academic, social, and professional life (Bistricky et al., 2018; Goetz & Teixeira, 2020).

During this phase, students may develop certain habits that, directly or indirectly, can be very harmful to their health (Sarhan et al., 2021). These habits are often linked to unhealthy eating and sleeping patterns as well as to the consumption of tobacco, alcohol, or drugs (Bistricky et al., 2018). It is also important to note that, given the prevalence of risk behaviors and indifference among higher education students, they become more vulnerable to developing Chronic Non-Communicable Diseases (NCDs) (Goetz & Teixeira, 2020), which, according to the World Health Organization (WHO), are "the major cause of adult illness and death in all regions of the world" (World Health Organization, 2005).

Tobacco consumption, whether in its traditional or electronic form, still plays a very active role in these students' lives and can consequently lead to poor sleep quality (World Health Organization, 2021). Therefore, it is essential to be aware and informed about the health issues linked to these habits and to understand their harmful effects. This need for knowledge is connected to health literacy, which represents the cognitive and social skills that determine individuals' motivation and ability to obtain, comprehend, and apply information to promote and maintain good health (Nutbeam, 1998).

In this regard, the main objective of this study is to understand, through a descriptive cross-sectional study, how health literacy is associated with tobacco consumption and the quality of sleep among higher education students.

2. LITERATURE REVIEW

2.1. HEALTH LITERACY

The concept of Health Literacy (HL) has been prominent for at least 5 decades (Sørensen et al., 2012), and its understanding is associated with broader levels of literacy (Nutbeam, 1998). Although the concept appeared in the 1970s, formal definitions only emerged two decades later and have since evolved. Therefore, there is no single, definitive interpretation of health literacy.

A narrower definition of the concept is related to the active involvement of patients in the planning and implementation of therapeutic regimes, emphasizing their ability to apply and understand literacy skills when engaging health-related materials (Nutbeam, 2000; Parker et al., 1995). In contrast to the previous definition, health literacy also represents an individual's cognitive and social abilities to access, understand, evaluate, and apply information that determines motivation and the ability to promote and maintain good health, making judgments and decisions about care and health promotion and disease prevention at an individual and community level (Nutbeam, 1998; Sørensen et al., 2012).

Nutbeam (2000) identified three distinct levels of literacy that progressively reflect greater autonomy and personal empowerment in decision-making. In a first instance, he presented functional health literacy, which entails the reading and writing skills necessary for effective functioning in everyday situations. From a more communicative perspective, he presented interactive health literacy, which covers more advanced social, cognitive, and literacy skills that enable individuals to actively participate in everyday activities by extracting and applying information. Finally, applying a more critical analysis, he also presented critical health literacy, which involves using the above skills to critically analyze information and exercise greater control over life events (Nutbeam, 2000).

In 2006, a new definition of health literacy emerged, emphasizing individuals' increased control over their health, their ability to seek information, and their responsibility in health-related matters. These authors defined HL as "the ability to make sound health decisions in the context of everyday life - at home, in the community, at the workplace, in the health care system, the marketplace, and the political arena." (Hopkins, 2006).

When discussing levels of health literacy, it is evident that lower levels of HL tend to be associated to a more significant number of risk behaviors and poorer health outcomes (Campos et al., 2022), as well as socio-economic disadvantages and difficulties in fully engaging in society and achieving specific life goals, which, in turn, contribute to a lower quality of life (Hopkins, 2006). Looking at it from the opposite perspective, higher levels of HL can be very advantageous when it comes to individuals obtaining health-related information

and applying it to their *modus vivendi* to modify and improve their state of health and develop healthier behaviors (Nutbeam, 2000).

In 2011, a European Health Literacy Survey (HLS-EU) was conducted across eight countries. In 2015, Portugal joined this initiative to assess the health literacy levels of its population and to identify and explore the main problems and potential strategies for improvement in this field (Espanha et al., 2015). According to the survey, 11% of the Portuguese respondents were characterized as having an inadequate level of HL, and around 38% had a problematic level of HL. This survey also revealed that the highest levels of health literacy were found among the younger and more qualified population. However, the proportion of the population with lower levels of health literacy was still relatively significant. Among participants aged between 15 and 25, 30.9% had problematic levels of health literacy, and 2.7% had inadequate levels. Similarly, for those aged between 26 and 35, the percentages were 32.4% and 3.8% for the same levels. Even among those with a "higher" level of education, 27.8% and 5.6% also had the same levels of health literacy.

On the other hand, a more recent study (Arriaga et al., 2022) revealed some improvements in the health literacy levels of the Portuguese population. The findings showed that only 7.5% of the participants had an inadequate level of HL, and 22% had a problematic level. Additionally, based on the collected sample, 70% of the Portuguese population had high levels of health literacy.

2.2. TOBACCO CONSUMPTION

In addition to other components, tobacco, whether in its traditional or electronic form, contains nicotine, which is the primary element responsible for tobacco addiction. This component has a detrimental effect on sleep architecture, resulting essentially in disturbances during sleep due to its influence on a region of the central nervous system that regulates the sleep-wake cycle (Mesquita et al., 2010). Furthermore, nicotine also has an effect on lung function and airway inflammation, resulting in a greater likelihood of snoring and sleep apnea. Considering all the consequences associated with tobacco consumption, disturbances in the sleep structure can be highlighted, such as increased latency, daytime sleepiness, and decreased sleep efficiency (Araújo et al., 2014).

Nowadays, cigarettes are available in different forms, many of them as alternatives to traditional cigarettes. However, there is still no scientific evidence that these new products are not harmful to people's health. Standard electronic cigarettes, or "e-cigarettes", also contain nicotine and are therefore harmful, even though younger people see them as less harmful compared to other forms of tobacco (Brett et al., 2020).

In 2020, worldwide, the average rate of tobacco consumption among young people aged 15 to 24 was 14.2%, while the rate for those aged 25 to 34 was 21.7%. According to the World

Health Organization, this rate is expected to continue to decline, reaching an estimated 13.0% by 2025 (World Health Organization, 2021).

Smoking has been identified as one of the four health behaviors most strongly linked to non-communicable diseases. In 2016, because of the consequences associated with its consumption, around six million deaths were recorded (Brandt et al., 2019). Despite the downward trend and numerous measures and policies adopted to reduce tobacco consumption over time, its effects continue to have a major impact on the quality of life of smokers and those around them (Parisod et al., 2016). Statistics have revealed that passive smoking can be life-threatening. In 2023, the WHO pointed out that 1.3 million non-smokers will die each year (World Health Organization, 2023).

Some authors have identified that lower levels of HL among adolescents are associated with a lower perception and evaluation of the consequences of certain health-related behaviors, including tobacco consumption. According to (Campos et al., 2022), tobacco consumption is three times more likely in adolescents with low levels of literacy compared with adolescents with high levels of health literacy. Therefore, preventive measures against tobacco consumption are especially important among higher education students, given the high probability of smoking habits established during this period continuing into adulthood (Parisod et al., 2016).

2.3. SLEEP QUALITY

The proper functioning of the body, daily physical and mental performance, and a good quality of life are intrinsically linked to a good quality of sleep and health. For this reason, sleep is seen as a fundamental physiological necessity for human beings with a strong impact on the quality and longevity of the population (Correia et al., 2022).

Sleep quality literacy is essential for promoting healthier sleep patterns, recognizing potential sleep problems, and preventing damage to physical and psychosocial health, as well as professional and academic performance and risk-related behaviors (Almeida et al., 2020).

In this context, the lack of consistent sleep hygiene practices can lead to various consequences, such as daytime sleepiness, possible sleep disorders, lack of concentration, or other mental disorders (Hershner & Chervin, 2014). This is particularly significant for higher education students, who often experience periods of insufficient sleep (Araújo et al., 2014). Not just based on this indicator, but a good quality of sleep is essential for good academic performance in higher education students. For these students, poor sleep quality can lead to a lower level of concentration and motivation, a memory deficit, excessive daytime sleepiness, and a decline in immunity (Mesquita et al., 2010).

2.4. OBJECTIVES

Following a comprehensive review of the existing literature on the main topics covered in this thesis and their potential relationships, a study was carried out in universities and polytechnic institutes throughout Portugal. This study aimed to explore the relationship between health literacy, tobacco consumption, and sleep quality among higher education students in Portugal. Therefore, the main objective was to determine how health literacy might affect tobacco consumption and sleep quality among these students. The study was also supported by specific goals: to describe individually the levels of health literacy, sleep quality, and tobacco consumption in higher education students; to understand the association between health literacy and tobacco consumption; to analyze the association between health literacy and sleep patterns; and to explore how tobacco consumption is associated with sleep quality.

3. METHODOLOGY

3.1. DATA

3.1.1. STUDY DESIGN AND SETTING

A quantitative methodology was used, and an observational cross-sectional study was conducted between April and November 2024 to analyze this research's goals and the reality of a sample of Higher Education Students.

3.1.2. SAMPLE AND PARTICIPANTS

In this study, all students aged 18 or over, regardless of their professional status and who had or were doing at least a Bachelor's degree or a higher level of education (Postgraduate, Master's, or PhD), were eligible to participate. It is also important to highlight that those who completed their degree less than a year ago were also eligible. Therefore, a total of 450 questionnaires were collected, of which 401 (89.11%) were fully completed and subsequently considered for the analysis.

3.1.3. DATA COLLECTION

Two online questionnaires were administered using the Qualtrics XM tool to achieve a more representative sample. One was in English, and the other was in Portuguese, allowing respondents to choose between the two languages. Initially, participants were informed of the study's objectives and requested to provide their cooperation in its completion. These questionnaires enabled a more detailed analysis of the main objectives of this research, which are to gain a deeper understanding of health literacy, nicotine dependence related to cigarette use, and sleep quality among higher education students. These factors were measured through the Health Literacy Survey Questionnaire (HLS_{19}-Q12), the Fagerström Test for Nicotine Dependence (FTND), and the Pittsburgh Sleep Quality Index (PSQI), respectively.

In addition to the questions related to the measurement tools mentioned above, the study also incorporated sociodemographic questions to obtain a more detailed characterization of the respondents. This data collection included information about their gender, age, academic qualifications, fields of study, and employment status.

The online questionnaires were distributed across various digital platforms, including LinkedIn, Facebook, Instagram, and WhatsApp, and were also shared via email with students from Nova Information Management School and other individuals considered eligible for the study.

Before conducting this study, approval was secured from the Ethics Committee of NOVA Information Management School. Eligible participants were invited to participate and assured that their participation would remain strictly confidential and their identities anonymous.

3.1.4. MEASURES

The present study was based on three indicators that supported its results.

3.1.4.1. HEALTH LITERACY SURVEY QUESTIONNAIRE (HLS19-Q12)

Table 3.1. HLS-EU Health Literacy Matrix based on the Conceptual Model

	Access/obtain information relevant to health	Understand information relevant to health	Process/appraise information relevant to health	Apply/use information relevant to health
Healthcare	Ability to access information on medical and clinical issues	Ability to understand medical information and derive meaning	Ability to interpret and evaluate medical information	Ability to make informed decisions on medical issues
Disease prevention	Ability to access information on risk factors for health	Ability to understand information on risk factors and derive meaning	Ability to interpret and evaluate information on risk factors for health	Ability to make informed decisions on risk factors for health
Health promotion	Ability to update oneself on determinants of health in the social and physical environment	Ability to understand information on determinants of health in the social and physical environment and derive meaning	Ability to interpret and evaluate information on health determinants in the social and physical environment	Ability to make informed decisions on health determinants in the social and physical environment

The HLS19-Q12 is a 12-item questionnaire derived from a more extensive 47-item questionnaire (HLS-Q47). Through it, it was evaluated the general health literacy among higher education students, three specific domains of health literacy (health promotion, disease prevention, and healthcare), as well as four aspects of health-related information management to access, understand, appraise, and apply information relevant for health (**Table 3.1**) (Sørensen et al., 2013).

Each component of the HL conceptual matrix is represented by an item, with responses ranging from "Very easy" to "Very difficult". An additional response option of "Don't know" is available but is treated as missing data for the analysis. Each response is associated with a numerical value between 1 and 4, where 1 corresponds to “Very difficult”, 2 to “Difficult”, 3 to “Easy”, and 4 to “Very easy”.

The health literacy levels were standardized on a variable metric scale ranging from 0 to 50. In order to categorize these levels, specific cut-off points were established: below 25 points; between 26 and 33 points; between 34 and 42 points; and above 43 points. In alignment with the HLS-EU study categories, these cut-offs were defined as follows: “Inadequate” and “Problematic” for low health literacy and “Sufficient” and “Excellent” for high health literacy.

3.1.4.2. FAGERSTRÖM TEST FOR NICOTINE DEPENDENCE (FTND)

The Fagerström Test for Nicotine Dependence (Heatherton et al., 1991) is a tool used to evaluate the level of nicotine dependence in individuals who smoke cigarettes. This test contains six questions (three multiple-choice items and three yes/no items), which measure the quantity of cigarettes consumed, the frequency of smoking, and the degree of nicotine dependence in participants.

Each response is assigned a corresponding score: a score of 0 indicates a “no” answer, while a score of 1 indicates a “yes” answer. For multiple-choice questions, the scoring ranges from

0 to 3, reflecting varying levels of dependency. A score of 0 represents very low dependence, while 3 represents a very high dependence.

The cumulative score of all the questions determines the level of nicotine dependence of the respondent, which ranges from 0 to 10. A score of 0 to 2 indicates very low dependence, 3 to 4 indicates low dependence, 5 indicates moderate dependence, 6 to 7 reflects high dependence, and a total score of 8 to 10 reflects very high dependence.

3.1.4.3. PITTSBURGH SLEEP QUALITY INDEX (PSQI)

The Pittsburgh Sleep Quality Index (Buysse et al., 1989) is a self-report questionnaire designed to evaluate sleep quality over the course of one month. The PSQI comprises 19 items, of which only nine actually contribute to the total score. It measures seven scoring components related to subjective sleep quality, sleep latency, sleep duration, sleep efficiency, use of sleep medication, and daytime dysfunction.

Each component is scored on a scale from 0 (no difficulty) to 3 (severe difficulty). By summing the scores from all the seven components, a global score (Global PSQI Score) is obtained for each participant. This global score can range from 0 to 21, with higher scores reflecting poorer sleep quality and with a score greater than 5 suggesting significant sleep difficulties.

3.2. STATISTICAL ANALYSIS

Descriptive statistics were calculated, including mean and standard deviation (SD) for quantitative variables, as well as absolute and relative frequencies for qualitative variables. Statistical analysis was conducted using R Studio, with a significance level of p-value < 0.05.

The normality of the data distribution and homogeneity of variances were tested using the Shapiro-Wilk test and Levene's test, respectively. A t-test was used to determine if there were statistically significant differences in health literacy and sleep quality (continuous and dependent variables) between two groups (categorical and independent variables). For comparisons involving three or more groups, One-way ANOVA was used to evaluate if at least one group's mean differed significantly from the others. A Pearson's Chi-squared test was also conducted to investigate potential associations between health literacy and other categorical variables, as well as a Monte Carlo Simulation to explore the relationship between HL and gender, HL and age, and nicotine dependence and other categorical variables. Additionally, the adjusted standardized residuals were also subjected to analysis to gain further insight and to identify which specific groups differ significantly from each other.

In order to have a more accurate analysis, a linear regression analysis was performed, leading to the development of two multiple linear regression models that identified the potential risk factors associated with HL. The first model included the significant sociodemographic variables and the PSQI scores, while the second included the significant sociodemographic variables, the PSQI scores, and the FTND scores (considering only smokers).

4. RESULTS

4.1. SOCIODEMOGRAPHIC CHARACTERISTICS

Table 4.1. Sociodemographic Characteristics of the Participants (n = 401)

		n (%)
Gender	Female	198 (49.38%)
	Male	196 (48.88%)
	Prefer not to answer	7 (1.75%)
Age Groups	18 -24	246 (61.35%)
	25 - 29	134 (33.42%)
	30 or more	21 (5.24%)
Academic Qualification	Bachelor's Degree	221 (55.11%)
	Post-Graduate	30 (7.48%)
	Master's Degree & PhD's Degree	150 (37.41%)
Type of Institution	Polythecnic	167 (41.65%)
	University	234 (58.35%)
Area of Study	Health & Life Sciences	114 (28.43%)
	Others than Health & Life Sciences	287 (71.57%)
Student-Worker	Non-Student-Worker	154 (38.40%)
	Student-Worker	247 (61.60%)

The total sample was comprised of 401 participants, with a nearly equal distribution of male and female respondents. The mean age of the participants was 24 ± 3.17 years, as most of the sample (61.35%) was aged between 18 and 24. The majority of participants (55.11%) had completed or were completing a bachelor's degree, and 58.35% had attended or were attending university. Regarding the area of study, 287 students (71.57%) were enrolled in courses unrelated to the areas of health and life sciences, and most participants (61.60%) worked and studied at the same time (**Table 4.1**).

4.2. HEALTH LITERACY SURVEY QUESTIONNAIRE (HLS$_{19}$-Q12)

Health literacy among higher education students was evaluated, revealing an average HL score of 33.835 ± 7.274, which suggests, on average, that these students have a “sufficient” level of health literacy.

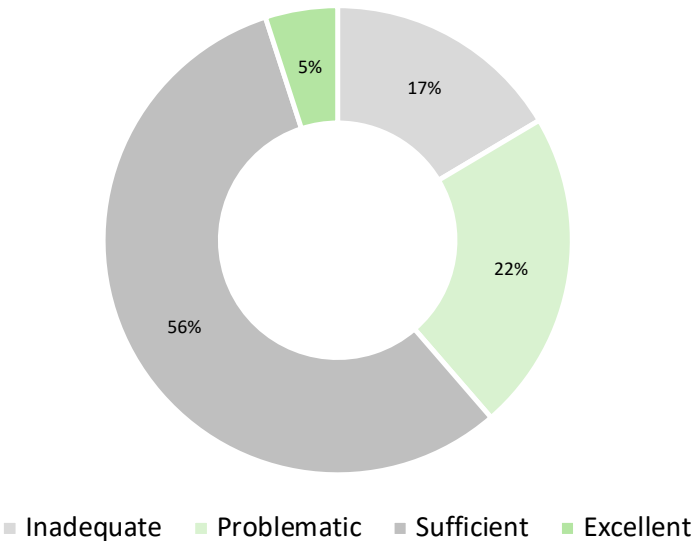
Through the results of the HLS$_{19}$-Q12, which are summarized in **Table 4.2**, it can be concluded that for all the questions presented in the respective questionnaire, the majority of the participants considered it “easy” to find, understand, judge, and follow or decide health-related information.

Table 4.2. Results of the Health Literacy Survey Questionnaire - HLS19-Q12- (n (%))

On a scale from very easy to very difficult, how easy would you say it is to …	Very Difficult	Difficult	Easy	Very Easy	Don't Know
… find information on treatments of illnesses that concern you?	8 (2.00%)	71 (17.71%)	236 (58.85%)	86 (21.45%)	0 (0.00%)
… understand what to do in a medical emergency?	10 (2.49%)	66 (16.46%)	246 (61.35%)	79 (19.70%)	0 (0.00%)
… judge the advantages and disadvantages of different treatment options?	8 (2.00%)	92 (22.94%)	248 (61.85%)	52 (12.97%)	1 (0.25%)
… follow the instructions on medication?	4 (1.00%)	31 (7.73%)	217 (54.11%)	148 (36.91%)	1 (0.25%)
… find information on how to manage mental health problems like stress or depression?	10 (2.49%)	80 (19.95%)	237 (59.10%)	74 (18.45%)	0 (0.00%)
… understand why you need health screenings?	6 (1.50%)	50 (12.47%)	178 (44.39%)	167 (41.65%)	0 (0.00%)
… judge if the information on health risks in the media is reliable?	9 (2.24%)	84 (20.95%)	243 (60.60%)	61 (15.21%)	4 (1.00%)
… decide how you can protect yourself from illness based on advice from family and friends?	5 (1.25%)	102 (25.44%)	226 (56.36%)	68 (16.96%)	0 (0.00%)
… find information on healthy activities such as exercise, healthy food and nutrition?	3 (0.75%)	53 (13.22%)	206 (51.37%)	138 (34.41%)	1 (0.25%)
… understand information on food packaging?	4 (1.00%)	51 (12.72%)	232 (57.86%)	113 (28.18%)	1 (0.25%)
… judge which everyday behaviour is related to your health?	8 (2.00%)	68 (16.96%)	253 (63.09%)	71 (17.71%)	1 (0.25%)
… make decisions to improve your health?	5 (1.25%)	84 (20.95%)	227 (56.61%)	85 (21.20%)	0 (0.00%)

According to **Figure 4.1**, 56% of the participants revealed to have a “sufficient” HL, 22% a “problematic” HL, 17% an “inadequate” HL, and just 5% an “excellent” HL. Overall, this indicates that, despite the low expression of the “excellent” category in the sample, there are more participants showing higher levels of health literacy (“excellent” and “sufficient” levels) than lower levels of health literacy (“problematic” and “inadequate” levels).

Figure 4.1. General Health Literacy (%)



Regarding the domains of health literacy, these were also calculated by grouping together all the HLS19-Q12 items corresponding to each domain: health promotion, disease prevention, and health care. The results are reflected in **Table 4.3**, which shows that disease prevention and health care domains have the lowest levels of HL, and the health promotion domain has the highest levels of HL.

Students revealed that it is more difficult to evaluate information about risk factors for their health (disease prevention), as 20.70% of them showed an inadequate level in this domain. The same is true when it comes to evaluating medical information and complying with medical advice, where 37.41% of these students showed a problematic level in the healthcare domain. In contrast to the other two domains, the students were able to update themselves regularly on the determinants of health (health promotion), since 39.40% showed a sufficient level of HL and 9.23% an excellent level of HL in this domain.

Table 4.3. Domains of General Health Literacy (%)

	Health Promotion	Disease Prevention	Health Care
Inadequate	15.71%	20.70%	18.45%
Problematic	35.66%	35.41%	37.41%
Sufficient	39.40%	38.40%	35.91%
Excellent	9.23%	5.49%	8.23%

The HLS19-Q12 also assessed higher education students' ability to access, understand, appraise, and apply health-related information (**Table 4.4**). Students seem to have difficulties in all the above aspects, as 44.89% of them presented problematic levels in accessing health-related information, 39.90% in understanding information, 58.60% in appraising information, and 55.36% in applying information. However, it should be noted that 21.95% and 24.94% of these students revealed sufficient and excellent levels in understanding health literacy information.

Table 4.4. Aspects of Health-Related Information Management (%)

	Access Information	Understand Information	Appraise Information	Apply Information
Inadequate	16.21%	19.20%	20.45%	12.22%
Problematic	44.89%	39.90%	58.60%	55.36%
Sufficient	19.70%	21.95%	9.23%	15.46%
Excellent	19.20%	24.94%	11.72%	16.96%

The statistical analysis conducted (**Table 4.5**) revealed that there is a significant discrepancy between the mean scores of the HLS19-Q12 in the following sociodemographic variables: gender ($p < 0.001$), academic qualification ($p < 0.001$), and area of study ($p < 2.2e\text{-}16$). Female students presented an average score of 35.2 and male students, an average score of 32.7, suggesting that women have higher levels of health literacy than men. The small percentage of students that were doing or had done a post-graduate showed lower HL levels than the others who were doing or had done a bachelor's degree, a master's degree or a PhD, presenting an average score of 29.1. Regarding the area of study, it was also clear that students enrolled in health and life sciences courses had higher average scores of HL than those enrolled in courses unrelated to the areas in question, presenting an average score of 39.2.

Table 4.6 also revealed that health literacy levels are significantly (p-value < 0.05) associated with higher education students' gender, academic qualification, area of study, and professional status.

Table 4.5. Two Sample t-test & One-Way ANOVA test - HLS19-Q12

Gender	n	Mean	Standard Deviation	p-value
Female	198 (49.38%)	35.2	6.07	< 0.001
Male	196 (48.88%)	32.7	8.20	
Age Groups	**n**	**Mean**	**Standard Deviation**	**p-value**
18 -24	246 (61.35%)	34.0	6.87	0.397
25 - 29	134 (33.42%)	33.4	8.12	
30 or more	21 (5.24%)	35.7	7.11	
Academic Qualification	**n**	**Mean**	**Standard Deviation**	**p-value**
Bachelor's Degree	221 (55.11%)	34.2	6.71	< 0.001
Post-Graduate	30 (7.48%)	29.1	7.54	
Master's Degree & PhD's Degree	150 (37.41%)	34.3	7.84	
Type of Institution	**n**	**Mean**	**Standard Deviation**	**p-value**
Polythecnic	167 (41.65%)	33.5	6.87	0.3653
University	234 (58.35%)	34.2	7.63	
Area of Study	**n**	**Mean**	**Standard Deviation**	**p-value**
Health & Life Sciences	114 (28.43%)	39.2	5.39	< 2.2e-16
Others than Health & Life Sciences	287 (71.57%)	31.8	6.90	
Student-Worker	**n**	**Mean**	**Standard Deviation**	**p-value**
Non-Student-Worker	154 (38.40%)	34.8	6.17	0.062
Student-Worker	247 (61.60%)	33.4	7.92	

Table 4.6. Pearson's Chi-squared test (HLS19-Q12)

	p-value
Gender	3.541e-06
Age Groups	0.485
Academic Qualification	0.002
Type of Institution	0.336
Area of Study	< 2.2e-16
Student-Worker	0.040

Two multiple linear regression models were developed in order to identify potential risk factors associated with health literacy. The first model included the significant sociodemographic variables and the PSQI scores, while the second included the significant sociodemographic variables, the PSQI scores, and the FTND scores (considering only smokers), where it can be concluded that HL is associated with sleep quality and nicotine dependence, which can be seen in Annex A, Figure 1 e Figure 2.

4.3. FAGERSTRÖM TEST FOR NICOTINE DEPENDENCE (FTND)

The respondents answered the question, "Do you currently smoke?" to which 46.13% of the sample (185 respondents) answered "yes" and 216 respondents (53.87%) answered "no". For the analysis of nicotine dependence, only those who answered "yes" were considered: 48 women, 131 men, and 6 who preferred not to indicate their gender.

According to **Table 4.7**, the majority of students who reported having smoking habits were aged between 18 and 24 (62.70%), were doing or had done a bachelor's degree (52.43%), in courses not related to health or life sciences (83.24%), at a university (55.14%), and were only dedicated to their studies (67.03%).

The statistical analysis conducted reveals significant evidence (p-value < 0.05) that nicotine dependence differs between females and males, across the three age groups specified, depending on the type of institution frequented and between non-student workers and student workers (**Table 4.7**).

Table 4.7. Pearson's Chi-squared test with a simulated p-value (FTDN)

Gender	**n**	**Mean**	**Standard Deviation**	**p-value**
Female	48 (25.95%)	3.65	2.27	0.0004
Male	131 (70.81%)	4.78	1.79	
Age Groups	**n**	**Mean**	**Standard Deviation**	**p-value**
18 -24	116 (62.70%)	4.40	2.13	0.037
25 - 29	62 (33.51%)	4.79	1.60	
30 or more	7 (3.78%)	4.14	2.34	
Academic Qualification	**n**	**Mean**	**Standard Deviation**	**p-value**
Bachelor's Degree	97 (52.43%)	4.41	2.13	0.195
Post-Graduate	21 (11.35%)	5.19	1.60	
Master's Degree & PhD's Degree	67 (36.22%)	4.46	1.83	
Type of Institution	**n**	**Mean**	**Standard Deviation**	**p-value**
Polythecnic	83 (44.86%)	4.27	2.10	0.024
University	102 (55.14%)	4.73	1.86	
Area of Study	**n**	**Mean**	**Standard Deviation**	**p-value**
Health & Life Sciences	31 (16.76%)	3.52	2.16	0.227
Others than Health & Life Sciences	154 (83.24%)	4.72	1.88	
Student-Worker	**n**	**Mean**	**Standard Deviation**	**p-value**
Non-Student-Worker	61 (32.97%)	4.02	2.29	0.053
Student-Worker	124 (67.03%)	4.77	1.76	

The results of the FTND are summarized in **Table 4.8**, indicating that 34.59% of eligible respondents smoke their first cigarette 6 to 30 minutes after waking up. More than half of the students (62.70%) report that they do not struggle to refrain from smoking in places where it is prohibited, and 61.62% would hate to give up their first cigarette of the morning. With regard to cigarettes smoked per day, 46.49% of students smoke between 11 and 20 cigarettes daily, 59.46% smoke more frequently in the first few hours after waking up than during the rest of the day, and 52.97% smoke even when they are very ill, spending most of the day in bed. Overall, this study concluded that higher education students have moderate nicotine dependence, with the highest percentages falling into low and high nicotine dependence: 30.81% and 32.43%, respectively, as illustrated in **Table 4.9**.

Table 4.8. Results of the Fagerström Test for Nicotine Dependence - FTND - (n (%))

1. How soon after you wake up do you smoke your first cigarette?	**After 60 minutes**	**31 - 60 minutes**	**6 - 30 minutes**	**Within 5 minutes**	**Within 5 minutes**
	40 (21,62%)	40 (21,62%)	64 (34,59%)	41 (22,16%)	41 (22,16%)
2. Do you find it difficult to refrain from smoking in places where it is forbidden (e.g., in church, at the library, in the cinema)?	**No**	**Yes**			
	116 (62,70%)	69 (37,30%)			
3. Which cigarette would you hate most to give up?	**All Others**	**The first one in the morning**			
	71 (38,38%)	114 (61,62%)			
4. How many cigarettes per day do you smoke?	**10 or less**	**11 - 20**	**21 - 30**	**31 or more**	**31 or more**
	67 (36,22%)	86 (46,49%)	28 (15,14%)	4 (2,16%)	4 (2,16%)
5. Do you smoke more frequently during the first hours after waking than during the rest of the day?	**No**	**Yes**			
	75 (40,54%)	110 (59,46%)			
6. Do you smoke when you are so ill that you are in bed most of the day?	**No**	**Yes**			
	87 (47,03%)	98 (52,97%)			

Table 4.9. Classification of Dependence - FTDN Scores - (n (%))

Classification of Dependence	
Very Low (0 -2)	28 (15,14%)
Low (3 - 4)	57 (30,81%)
Moderate (5)	36 (19,46%)
High (6 -7)	60 (32,43%)
Very High (8 - 10)	4 (2,16%)
Mean ± SD	
4.519 ± 1.976	

At the end of this test, a final question was asked about the type of tobacco consumed by the students. The results revealed that industrialized cigarettes are the most commonly used by these individuals, with a prevalence of 70.81% (**Table 4.10**).

Table 4.10. Types of tobacco (n (%))

Types of Tobacco	
Industrialized cigarette	131 (70.81%)
Cigarillo	5 (2.70%)
Narghile (Shisha, water pipe, …)	15 (8.11%)
Electronic cigarettes	33 (17.84%)
Pipes e Bongs	1 (0.54%)

The linear regression models conducted indicate that poorer sleep quality (higher PSQI scores) is associated with increased nicotine dependence ($p = 0.042$), that male students have higher nicotine dependence than female students ($p = 0.0006$) and the same is true for students enrolled in courses not related to health or life sciences compared to others enrolled in courses related to health or life sciences ($p = 0.002$), as can be seen in Annex A, Figure 3.

4.4. PITTSBURGH SLEEP QUALITY INDEX (PSQI)

The PSQI was completed for all the 401 participants, and their responses are summarized in **Table 4.11**. The first four questions were open-ended and, therefore, are not included in the table. This questionnaire was based on the respondents' sleeping habits over the past month, according to the date of each individual's response.

Table 4.11. Results of the Pittsburgh Sleep Quality Index - PSQI - (n (%))

5. During the past month, how often have you had trouble sleeping because you…	**Not during the past month**	**Less than once a week**	**Once or twice a week**	**Three or more times a week**
a) Cannot get to sleep within 30 minutes	101 (25.19%)	152 (37.91%)	78 (19.45%)	70 (17.46%)
b) Wake up in the middle of the night or early morning	78 (19.45%)	159 (39.65%)	103 (25.69%)	61 (15.21%)
c) Have to get up to use the bathroom	101 (25.19%)	171 (42.64%)	99 (24.69%)	30 (7.48%)
d) Cannot breathe comfortably	231 (57.61%)	113 (28.18%)	46 (11.47%)	11 (2.74%)
e) Cough or snore loudly	194 (48.38%)	122 (30.42%)	67 (16.71%)	18 (4.49%)
f) Feel too cold	228 (56.86%)	97 (24.19%)	44 (10.97%)	32 (7.98%)
g) Feel too hot	161 (40.15%)	156 (38.90%)	62 (15.46%)	22 (5.49%)
h) Have bad dreams	147 (36.66%)	149 (37.16%)	92 (22.94%)	13 (3.24%)
i) Have pain	226 (56.36%)	119 (29.68%)	42 (10.47%)	14 (3.49%)
j) Other reason(s), please describe:	0 (0.00%)	0 (0.00%)	2 (0.50%)	11 (2.74%)
6. During the past month, how would you rate your sleep quality overall?	**Very good**	**Fairly good**	**Fairly bad**	**Very bad**
	79 (19.70%)	227 (56.61%)	75 (18.70%)	20 (4.99%)
7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?	**Not during the past month**	**Less than once a week**	**Once or twice a week**	**Three or more times a week**
	267 (66.58%)	103 (25.69%)	21 (5.24%)	10 (2.49%)
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	161 (40.15%)	155 (38.65%)	57 (14.21%)	28 (6.98%)
9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	**No problem at all**	**Only a very slight problem**	**Somewhat of a problem**	**A very big problem**
	77 (19.20%)	174 (43.39%)	119 (29.68%)	31 (7.73%)
10. Do you have a bed partner or room mate?	**No bed partner or roommate**	**Partner/room mate in other room**	**Partner in same room. but not same bed**	**Partner in same bed**
	174 (43.39%)	27 (6.73%)	106 (26.43%)	94 (23.44%)
If you have a room mate or bed partner, ask him/her how often in the past month you have had:	**Not during the past month**	**Less than once a week**	**Once or twice a week**	**Three or more times a week**
a) Loud snoring	55 (13.72%)	72 (17.96%)	49 (12.22%)	24 (5.99%)
b) Long pauses between breaths while asleep	88 (21.95%)	68 (16.96%)	37 (9.23%)	7 (1.75%)
c) Legs twitching or jerking while you sleep	120 (29.93%)	49 (12.22%)	22 (5.49%)	9 (2.24%)
d) Episodes of disorientation or confusion during sleep	100 (24.94%)	79 (19.70%)	13 (3.24%)	8 (2.00%)
e) Other restlessness while you sleep, please describe:	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (0.25%)

According to participants' responses, 58.35% of higher education students usually went to bed at night between 23:00 and 00:00, while 81.05% took up to 30 minutes to fall asleep. Additionally, 67.83% woke up in the morning between 06:30 and 08:00, and 75.81% reported getting between 6 and 8 hours of actual sleep at night.

Several factors have been identified as contributors to the sleep disturbances experienced by these students. Based on the range of reasons enumerated in question 5 of the survey under analysis, it was determined that many students faced trouble sleeping, essentially because they could not fall asleep within 30 minutes (36.91%), because they had to wake up in the middle of the night or early in the morning (40.90%) and because they had to get up to go to the bathroom (32.17%).

According to **Table 4.12**, 227 of the students surveyed had fairly good subjective sleep quality, and 186 had fairly good sleep latency. Notably, 34.41% of the participants slept more than 7 hours, and 81.55% had at least 85% efficient sleep. When it came to sleep disturbances, 297 students experienced them less than once a week, 267 did not use sleep medication, and 50.62% of the students had little difficulty being alert or awake during the day. Overall, 266 (66.33%) of the higher education students were identified as poor sleepers (PSQI > 5) (**Table 4.13**), since the average PSQI global score calculated by summing the component scores was 6.696 ± 2.793. This average exceeds the cut-off point suggested for those considered "good sleepers" (5), indicating significant sleep difficulties among the participants.

Table 4.12. Components Scores – PSQI – (n (%))

	Very good	Fairly good	Fairly bad	Very bad
Component 1: Subjective sleep quality	79 (19.70%)	227 (56.61%)	75 (18.70%)	20 (4.99%)
Component 2: Sleep latency	73 (18.20%)	186 (46.38%)	101 (25.19%)	41 (10.22%)
Component 3: Sleep duration	138 (34.41%)	115 (28.68%)	108 (26.93%)	40 (9.98%)
Component 4: Sleep efficiency	327 (81.55%)	57 (14.21%)	8 (2.00%)	9 (2.24%)
Component 5: Sleep disturbance	8 (2.00%)	297 (74.06%)	96 (23.94%)	0 (0.00%)
Component 6: Use of sleep medication	267 (66.58%)	103 (25.69%)	21 (5.24%)	10 (2.49%)
Component 7: Daytime dysfunction	51 (12.72%)	203 (50.62%)	122 (30.42%)	25 (6.23%)

Table 4.13. Global PSQI Scores (n (%))

		PSQI ≤ 5 (n = 135)	PSQI > 5 (n = 266)
Gender	Female	73 (54.07%)	125 (46.99%)
	Male	59 (43.70%)	137 (51.50%)
	Prefer not to answer	3 (2.22%)	4 (1.50%)
Age Groups	18 -24	93 (68.89%)	153 (57.52%)
	25 - 29	34 (25.19%)	100 (37.59%)
	30 or more	8 (5.93%)	13 (4.89%)
Academic Qualification	Bachelor's Degree	80 (59.26%)	141 (53.01%)
	Post-Graduate	13 (9.63%)	17 (6.39%)
	Master's Degree & PhD's Degree	42 (31.11%)	108(40.60%)
Type of Institution	Polythecnic	68 (50.37%)	99 (37.22%)
	University	67 (49.63%)	167 (62.78%)
Area of Study	Health & Life Sciences	48 (35.56%)	66 (24.81%)
	Others than Health & Life Sciences	87 (64.44%)	200 (75.19%)
Student-Worker	Non-Student-Worker	66 (48.89%)	88 (33.08%)
	Student-Worker	69 (51.11%)	178 (66.92%)

Upon analyzing the statistical results from the PSQI, it was concluded that there is a statistically significant discrepancy between the mean scores obtained from this test in relation to age groups (p = 0.014), academic qualification (p = 0.009), type of institution (p = 0.013), area of study (p = 0.001), and professional status (p = 0.020). Students aged 25 to 29 presented the worst average sleep quality score (7.27) among the three age groups studied. Comparing the other significant sociodemographic variables, the worst average sleep quality score was observed in higher education students who were doing or had already done a master's degree or a PhD (7.23), in courses not related to health or life sciences (6.98), at a university (6.99), and for those who had to balance their studies with professional commitments (6.95), as can be seen in **Table 4.14**.

Table 4.14. Two Sample t-test & One-Way ANOVA test – PSQI

Gender	n	Mean	Standard Deviation	p-value
Female	198 (49.38%)	6.68	2.91	0.880
Male	196 (48.88%)	6.72	2.70	
Age Groups	**n**	**Mean**	**Standard Deviation**	**p-value**
18 -24	246 (61.35%)	6.41	2.65	0.014
25 - 29	134 (33.42%)	7.27	2.93	
30 or more	21 (5.24%)	6.33	3.09	
Academic Qualification	**n**	**Mean**	**Standard Deviation**	**p-value**
Bachelor's Degree	221 (55.11%)	6.43	2.71	0.009
Post-Graduate	30 (7.48%)	6.00	1.93	
Master's Degree & PhD's Degree	150 (37.41%)	7.23	2.98	
Type of Institution	**n**	**Mean**	**Standard Deviation**	**p-value**
Polythecnic	167 (41.65%)	6.29	2.54	0.013
University	234 (58.35%)	6.99	2.93	
Area of Study	**n**	**Mean**	**Standard Deviation**	**p-value**
Health & Life Sciences	114 (28.43%)	5.97	2.89	0.001
Others than Health & Life Sciences	287 (71.57%)	6.98	2.70	
Student-Worker	**n**	**Mean**	**Standard Deviation**	**p-value**
Non-Student-Worker	154 (38.40%)	6.29	2.87	0.020
Student-Worker	247 (61.60%)	6.95	2.72	

5. DISCUSSION

This study began by characterizing 401 higher education students and examining their levels of health literacy, smoking habits, and sleep patterns.

5.1. HEALTH LITERACY

The results indicated that 39% of higher education students have a limited health literacy (problematic or inadequate), and 61% have an adequate level (sufficient or excellent). In a study of university students at Tribhuvan University in Nepal (Bhusal et al., 2021), the opposite reality was found: 60.8% of students had limited health literacy. Like them, some other authors have reached very similar conclusions (Amaral et al., 2021; Pedro et al., 2022; Rosário et al., 2024). However, the reality may be different when it comes to the United States and Canada, where better levels of health literacy have been reported among higher education students (Hansen et al., 2015; Joseph et al., 2016).

Considering the domains of health literacy - health promotion, disease prevention, and health care - the students in this study showed higher levels of health literacy in the health promotion dimension, and although they seemed to have difficulties in accessing, understanding, evaluating, and applying health-related information, they found it easier to understand the information, as they showed higher levels in this aspect. This study is thus in line with what was also concluded in a study of (Arriaga et al., 2022).

In the lower HL levels, the male gender represents 58.06% of the category. At the highest levels of HL, the female gender stood out, with 54.07% of the category. In a study of university students in Turkey (Uysal et al., 2020), women were found to have a higher average HL score than men. Like him, other authors have also come to the same conclusion, such as (Wang et al., 2013) those who associated a healthier profile with female students. Contrary to what was found in this study, a study carried out in Nepal (Bhusal et al., 2021) also concluded that women are more likely to have limited health literacy than men.

In terms of age group, despite the fact that they are very small in the sample and the difference between age groups is not that significant, it was the older students (30 or over) who showed a less limited level of HL when compared to the younger students. The same was found in other studies (Amaral et al., 2021; Rosário et al., 2024) where the highest levels of HL were found in older students. However, it was found that the middle age group (25-29) was the one that stood out as having the highest number of students with problematic or inadequate levels of HL.

With regard to academic level, this study also found that students with a bachelor's degree were the ones who were more likely to have both more limited and less limited levels of HL, representing 49.68% and 58.54% respectively.

Similar to what has been concluded in other studies carried out in different parts of the world (Amaral et al., 2021; Bhusal et al., 2021; Evans et al., 2019; Joseph et al., 2016), in this study students in health-related or life sciences courses were identified as having higher levels of health literacy when compared to students in unrelated courses.

5.2. NICOTINE DEPENDENCE

According to the results obtained, a prevalence of tobacco consumption of 46.13% was found among the students, who had an average age of 23.5 years. This percentage was slightly more significant than that presented in other studies (Correa-López et al., 2020; Fernández Cernuda, 2015; Saraiva et al., 2017), where according to (Correa-López et al., 2020), of 447 students from five private universities in Peru, only 23.71% smoked. The same applied in the study by (Saraiva et al., 2017) where a prevalence of tobacco consumption of 25.2% was found among the nursing students who took part in the study.

The questionnaire carried out among the 185 students who answered that they had smoking habits showed that 30.81% of the students had a low nicotine dependence and 32.43% had a high nicotine dependence. However, it was also possible to conclude that a higher proportion of students (45.95%) had a low or very low level of nicotine dependence compared to students who had a high or very high level of nicotine dependence (34.59%). Despite the higher proportions, other studies are consistent with the results presented. In the study of (Santos, 2012) to young adults, 75% of the participants showed very low nicotine dependence. And in the study by (Saraiva et al., 2017) the rate was 78.4%, also for the lowest levels.

Among the students who smoked, male students stood out, accounting for 70.81% of the students. Female students accounted for 25.95%. Similar to this study, a study into the smoking habits of higher education students (Ramos, 2022), found that the proportion of smokers was higher among males, with 55%, compared to females, who accounted for 43.5% of students. In this study, among the lower levels of nicotine dependence, females were more prevalent (58.33%), and concerning the higher levels of nicotine dependence, males prevailed (37.40%).

In terms of areas of study, it can be concluded from the study in question that students in areas not related to health or life sciences account for 83.24% of student smokers. The remaining 16.76% correspond to students with smoking habits in health or life sciences-related courses. For all levels of nicotine dependence, ranging from very low, low, moderate, high, and very high, smokers in courses not related to health or life sciences stood out. This result is consistent with some studies of nursing students that found lower levels of nicotine dependence (Santos, 2012; Saraiva et al., 2017).

As the variables above are significant in the analysis of the nicotine dependence of these higher education students, student-workers are also important, given that 67.03% of students who are student-workers have smoking habits. Among working students who smoke, most students have a low or high nicotine dependence, representing 32.26% and 33.87%,

respectively. A previous study (Doğanay et al., 2017) verified that it is increasingly common for most people to work and study at the same time and concluded that this fact and nicotine dependence are interconnected, as 52.6% of evening students were revealed to be moderately dependent.

5.3. SLEEP QUALITY

The results showed that 66.33% of higher education students had poor sleep quality and 33.67% had adequate sleep quality. Among the variables considered significant were age, academic degree, type of institution, type of course, and the professional status of the students. Similar results were verified in the study of (Schmickler et al., 2023).

The study revealed that students aged between 18-24 and 25-29 had the poorest quality of sleep (95.11%). However, it is important to mention that it was students in the youngest age group who stood out in this category, accounting for 57.52% of students with poor sleep quality.

Students with a bachelor's degree, master's degree or PhD were the ones who stood out when analyzing sleep quality in higher education students. Overall, they accounted for 93.61% of students with poor sleep quality. However, it was undergraduate students who accounted for the largest proportion of students with poor sleep quality (53.01%).

Regarding the type of institution attended, it was found that there are more students with poor sleep quality at universities than at polytechnics. 62.78% of students with poor sleep quality were studying at a university.

According to the results presented, it was students on courses related to health or life sciences who stood out among the students with poor sleep quality, as they represented a lower percentage compared to students on courses not related to the areas in question.

6. CONCLUSIONS AND FUTURE WORKS

From this study, it can be concluded that higher education students still exhibit low levels of health literacy, although some progress has been made compared to other studies. Additionally, it was found that they have a moderate level of nicotine dependence and experience poor sleep quality.

Health literacy among higher education students was evaluated, revealing an average HL score of 33.835 ± 7.274, which suggested that these students have a “sufficient” level of health literacy on average. Furthermore, this study revealed that tobacco consumption is negatively correlated with sleep quality, that male students demonstrate higher nicotine dependence than female students, and that this pattern also holds for students enrolled in non-health-related courses compared to those in health or life sciences courses. Finally, most of the higher education students (66.33%) were identified as poor sleepers, as the mean overall PSQI score was 6.696 ± 2.793, which indicated significant sleep difficulties among these students.

Given the small range of variation in the sample of student smokers, it would be interesting to explore other regression models suitable for analyzing tobacco consumption and sleep quality in future studies. Furthermore, the development of personalized health literacy programs for different groups of students could be explored in order to increase effectiveness and address the specific needs of Higher Education and, consequently, improve the health literacy levels of these students.

BIBLIOGRAPHICAL REFERENCES

Almeida, B., Albuquerque, C., Cunha, M., & Antunes, A. (2020). Qualidade e hábitos de sono nos estudantes do ensino superior. *Millenium - Journal of Education, Technologies, and Health*, *7e*, Article 7e. https://doi.org/10.29352/mill0207e.10.00378

Alves, T. de A., Lira, A. C. da S., & Pachú, C. O. (2021). Aspectos biopsicossociais relacionados ao consumo de tabaco entre universitários: Uma revisão integrativa. *Research, Society and Development*, *10*(7), Article 7. https://doi.org/10.33448/rsd-v10i7.16250

Amaral, O., Pedro, A. R., Veiga, N., Escoval, A., & Ferreira, M. (2021). Health literacy in higher education students: Comparison of nursing students with students from other areas. Health literacy in higher education students in Viseu. *INFAD*, *2*(1), 97–106. https://doi.org/10.17060/ijodaep.2021.n1.v2.2122

Araújo, M. F. M. de, Freitas, R. W. J. F. de, Lima, A. C. S., Pereira, D. C. R., Zanetti, M. L., & Damasceno, M. M. C. (2014). Health indicators associated with poor sleep quality among university students. *Revista Da Escola de Enfermagem Da USP*, *48*, 1085–1092. https://doi.org/10.1590/S0080-623420140000700017

Arriaga, M., Francisco, R., Nogueira, P., Oliveira, J., Silva, C., Câmara, G., Sørensen, K., Dietscher, C., & Costa, A. (2022). Health Literacy in Portugal: Results of the Health Literacy Population Survey Project 2019–2021. *International Journal of Environmental Research and Public Health*, *19*(7), Article 7. https://doi.org/10.3390/ijerph19074225

Bhusal, S., Paudel, R., Gaihre, M., Paudel, K., Adhikari, T. B., & Pradhan, P. M. S. (2021). Health literacy and associated factors among undergraduates: A university-based cross-sectional study in Nepal. *PLOS Global Public Health*, *1*(11), e0000016. https://doi.org/10.1371/journal.pgph.0000016

Bistricky, S. L., Harper, K. L., Roberts, C. M., Cook, D. M., Schield, S. L., Bui, J., & Short, M. B. (2018). Understanding and Promoting Stress Management Practices Among College Students Through an Integrated Health Behavior Model. *American Journal of Health Education*, *49*(1), 12–27. https://doi.org/10.1080/19325037.2017.1377651

Brandt, L., Schultes, M.-T., Yanagida, T., Maier, G., Kollmayer, M., & Spiel, C. (2019). Differential associations of health literacy with Austrian adolescents' tobacco and alcohol use. *Public Health*, *174*, 74–82. https://doi.org/10.1016/j.puhe.2019.05.033

Brett, E. I., Miller, M. B., Leavens, E. L. S., Lopez, S. V., Wagener, T. L., & Leffingwell, T. R. (2020). Electronic cigarette use and sleep health in young adults. *Journal of Sleep Research*, *29*(3), e12902. https://doi.org/10.1111/jsr.12902

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*(2), 193–213. https://doi.org/10.1016/0165-1781(89)90047-4

Campos, S., Ferreira, M., Cardoso, A. P., Guiné, R., Aparício, G., & Nelas, P. (2022). Literacia em saúde nos estudantes do ensino superior: Estudo exploratório. *Millenium - Journal of Education, Technologies, and Health*, *10e*, Article 10e. https://doi.org/10.29352/mill0210e.25529

Correa-López, L. E., Morales Romero, A. M., Olivera Ruiz, J. E., Segura Márquez, C. L., Cedillo Ramirez, L., & Luna-Muñoz, C. (2020). Factores asociados al consumo de tabaco en estudiantes universitarios de Lima metropolitana. *Revista de La Facultad de Medicina Humana*, *20*(2), 55–60. https://doi.org/10.25176/RFMH.v20i2.2872

Correia, T., Santos, A., Cambulo, A., Almeida, A. M., Longo, J., & Valentim, O. (2022). Health Literacy and Sleep Quality in Nursing Students. *Medical Sciences Forum*, *17*(1), Article 1. https://doi.org/10.3390/msf2022017002

Doğanay, S., Özdemir, A. E., & Trabzon, Ş. (2017). Nicotine dependence level of university students relating to type of education and gender. International Journal of Health Services Research and Policy, 2(2), 74-79.

Espanha, R., Ávila, P., & Mendes, R. V. (2015). *Literacia em Saúde em Portugal*. Fundação Calouste Gulbenkian. https://gulbenkian.pt/publications/literacia-em-saude-em-portugal/

Evans, A.-Y., Anthony, E., & Gabriel, G. (2019). Comprehensive Health Literacy Among Undergraduates: A Ghanaian University-Based Cross-Sectional Study. *HLRP: Health Literacy Research and Practice*, *3*(4), e227–e237. https://doi.org/10.3928/24748307-20190903-01

Fernández Cernuda, I. (2015). *Consumo de tabaco en estudiantes de Ciencias de la Salud: Estudio de prevalencia = Tobacco use in health students: a prevalence study.* https://buleria.unileon.es/handle/10612/5081

Goetz, L., & Teixeira, R. C. (2020). Health Literacy Improves the Lifestyle of Undergraduate in Education Students. *Journal of Education and Development*, *4*(3), Article 3. https://doi.org/10.20849/jed.v4i3.787

Hansen, H. R., Shneyderman, Y., & Belcastro, P. A. (2015). Investigating the Association of Health Literacy With Health Knowledge and Health Behavior Outcomes in a Sample of Urban Community College Undergraduates. *American Journal of Health Education*, *46*(5), 274–282. https://doi.org/10.1080/19325037.2015.1055016

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K.-O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, *86*(9), 1119–1127. https://doi.org/10.1111/j.1360-0443.1991.tb01879.x

Hershner, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college students. *Nature and Science of Sleep*, *6*, 73–84. https://doi.org/10.2147/NSS.S62907

Hopkins, D. (2006, September 1). Navigating Health: The Role of Health Literacy. *ILCUK*. https://ilcuk.org.uk/navigating-health-the-role-of-health-literacy/

Joseph, R., Fernandes, S., Hyers, L., & O'Brien, K. (2016). Health literacy: A cross-disciplinary study in American undergraduate college students. *Journal of Information Literacy*, *10*(2), Article 2. https://doi.org/10.11645/10.2.2103

Mesquita, G., Ferreira, S., Rossini, S., Evelise, A., Soares, E., & Reimão, R. (2010). Effects of tobacco and alcohol consumption on sleep quality of university students. *Neurobiologia*, *74*, 19–27.

Nutbeam, D. (1998). Health Promotion Glossary. *Health Promotion International*, *13*(4), 349–364. https://doi.org/10.1093/heapro/13.4.349

Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International*, *15*(3), 259–267. https://doi.org/10.1093/heapro/15.3.259

Parisod, H., Axelin, A., Smed, J., & Salanterä, S. (2016). Determinants of tobacco-related health literacy: A qualitative study with early adolescents. *International Journal of Nursing Studies*, *62*, 71–80. https://doi.org/10.1016/j.ijnurstu.2016.07.012

Parker, R. M., Baker, D. W., Williams, M. V., & Nurss, J. R. (1995). The test of functional health literacy in adults. *Journal of General Internal Medicine*, *10*(10), 537–541. https://doi.org/10.1007/BF02640361

Pedro, A., Rosário, R., Monteiro, I., Cerqueira, M., Roque, S., Assunção, V., Brandão, D., Escoval, A., & Ferreira, P. (2022). Health literacy in higher education students: Findings

from a Portuguese study. *European Journal of Public Health*, *32*(Supplement_3), ckac130.140. https://doi.org/10.1093/eurpub/ckac130.140

Rababah, J. A., Al-Hammouri, M. M., Drew, B. L., & Aldalaykeh, M. (2019). Health literacy: Exploring disparities among college students. *BMC Public Health*, *19*(1), 1401. https://doi.org/10.1186/s12889-019-7781-2

Ramos, B. M. (2022). *Hábitos Tabágicos dos Estudantes do Ensino Superior*.

Rosário, J., Dias, S. S., Dias, S., & Pedro, A. R. (2024). Health literacy and its determinants among higher education students in the Alentejo region of southern Portugal—A cross-sectional survey. *PLOS ONE*, *19*(9), e0309806. https://doi.org/10.1371/journal.pone.0309806

Santos, D. M. B. (2012). *Razões que condicionam os adultos jovens a iniciar e a manter o consumo do tabaco* [bachelorThesis, [s.n.]]. https://bdigital.ufp.pt/handle/10284/3597

Saraiva, A., Chaves, C., Duarte, J., & Amaral, M. (2017). Tobacco dependence in nursing students. *Revista de Enfermagem Referência*, *IV Série*(12), 9–18. https://doi.org/10.12707/RIV16032

Sarhan, M. B. A., Fujii, Y., Kiriya, J., Fujiya, R., Giacaman, R., Kitamura, A., & Jimba, M. (2021). Exploring health literacy and its associated factors among Palestinian university students: A cross-sectional study. *Health Promotion International*, *36*(3), 854–865. https://doi.org/10.1093/heapro/daaa089

Schmickler, J. M., Blaschke, S., Robbins, R., & Mess, F. (2023). Determinants of Sleep Quality: A Cross-Sectional Study in University Students. *International Journal of Environmental Research and Public Health*, *20*(3), 2019. https://doi.org/10.3390/ijerph20032019

Sørensen, K., Van den Broucke, S., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., Brand, H., & (HLS-EU) Consortium Health Literacy Project European. (2012). Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health*, *12*(1), 80. https://doi.org/10.1186/1471-2458-12-80

Sørensen, K., Van den Broucke, S., Pelikan, J. M., Fullam, J., Doyle, G., Slonska, Z., Kondilis, B., Stoffels, V., Osborne, R. H., & Brand, H. (2013). Measuring health literacy in populations: Illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). *BMC Public Health*, *13*(1), 948. https://doi.org/10.1186/1471-2458-13-948

Uysal, N., Ceylan, E., & Koç, A. (2020). Health literacy level and influencing factors in university students. *Health & Social Care in the Community*, *28*(2), 505–511. https://doi.org/10.1111/hsc.12883

Wang, D., Xing, X.-H., & Wu, X.-B. (2013). Healthy Lifestyles of University Students in China and Influential Factors. *The Scientific World Journal*, *2013*(1), 412950. https://doi.org/10.1155/2013/412950

World Health Organization. (2005). *Preventing chronic diseases: A vital investment : WHO global report*. World Health Organization. https://iris.who.int/handle/10665/43314

World Health Organization. (2021, November 6). *WHO global report on trends in prevalence of tobacco use 2000-2025, fourth edition*. https://www.who.int/publications-detail-redirect/9789240039322

World Health Organization. (2023). *WHO report on the global tobacco epidemic, 2023: Protect people from tobacco smoke*. World Health Organization. https://www.who.int/publications-detail-redirect/9789240077164

APPENDIX A

NOVA IMS | Ethics Committee - APPROVED

QS Qualtrics Survey Software<noreply@qemailserver.com>

Reply Reply all Forward

To: Samira Almeida Carvalho de Boa Esperanca

Mon 06/05/2024 03:03

You don't often get email from noreply@qemailserver.com. Learn why this is important

This is to certify that

Project No.: **STAT2024-5-54342**

Project Title: **Health Literacy among Higher Education Students, its Relationship with Tobacco Consumption and Sleep Quality**

Principal Researcher: **Samira Almeida Carvalho de Boa Esperança**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 5/5/2024.

It is the Principal Researcher's responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via amendment or progress report, of

- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 5/5/2024

NOVA IMS Ethics Committee
ethicscommittee@novaims.unl.pt

ANNEX A

Figure 1. Multiple linear regression models - HLS19-Q12 – Model 1

```
> mod1 <- lm(HLS.POINTS~Factor_Q1 + Factor_Q2 + Factor_Q3 + Factor_Q5 + PSQI.SCORES, DATAMT)
> mod1

Call:
lm(formula = HLS.POINTS ~ Factor_Q1 + Factor_Q2 + Factor_Q3 +
    Factor_Q5 + PSQI.SCORES, data = DATAMT)

Coefficients:
(Intercept)   Factor_Q1M   Factor_Q22   Factor_Q23   Factor_Q32   Factor_Q33   Factor_Q52  PSQI.SCORES
    41.2047      -1.0859       0.6950       0.5666      -2.9014       0.8986      -6.7009      -0.3469

> summary(mod1)

Call:
lm(formula = HLS.POINTS ~ Factor_Q1 + Factor_Q2 + Factor_Q3 +
    Factor_Q5 + PSQI.SCORES, data = DATAMT)

Residuals:
     Min       1Q   Median       3Q      Max
-24.5882  -4.1227   0.5146   4.4520  13.5646

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  41.2047     0.9685  42.543  < 2e-16 ***
Factor_Q1M   -1.0859     0.6681  -1.625  0.10490
Factor_Q22    0.6950     0.7987   0.870  0.38477
Factor_Q23    0.5666     1.5270   0.371  0.71079
Factor_Q32   -2.9014     1.3350  -2.173  0.03036 *
Factor_Q33    0.8986     0.7884   1.140  0.25513
Factor_Q52   -6.7009     0.7525  -8.905  < 2e-16 ***
PSQI.SCORES  -0.3469     0.1189  -2.917  0.00374 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 6.39 on 386 degrees of freedom
  (7 observations deleted due to missingness)
Multiple R-squared:  0.2485,    Adjusted R-squared:  0.2349
F-statistic: 18.24 on 7 and 386 DF,  p-value: < 2.2e-16
```

Figure 2. Multiple linear regression models - HLS19-Q12 – Model 2

```
> mod2 <- lm(HLS.POINTS~ Factor_Q1 + Factor_Q2 + Factor_Q3 + Factor_Q5 + Factor_FTND + PSQI.SCORES, DATAMT2)
> mod2

Call:
lm(formula = HLS.POINTS ~ Factor_Q1 + Factor_Q2 + Factor_Q3 +
    Factor_Q5 + Factor_FTND + PSQI.SCORES, data = DATAMT2)

Coefficients:
         (Intercept)            Factor_Q1M            Factor_Q22            Factor_Q23            Factor_Q32            Factor_Q33            Factor_Q52
             34.0657                1.5266                -0.1725                1.1020                -0.6224                1.2258                -7.1219
      Factor_FTNDLow   Factor_FTNDModerate  Factor_FTNDVery High   Factor_FTNDVery Low           PSQI.SCORES
             10.0829                0.1085                -4.6852                9.6898                -0.4344

> summary(mod2)

Call:
lm(formula = HLS.POINTS ~ Factor_Q1 + Factor_Q2 + Factor_Q3 +
    Factor_Q5 + Factor_FTND + PSQI.SCORES, data = DATAMT2)

Residuals:
     Min       1Q   Median       3Q      Max
-15.4588  -3.5017  -0.4114   2.8524  16.8710

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)          34.0657     1.8713  18.204  < 2e-16 ***
Factor_Q1M            1.5266     1.0265   1.487   0.1388
Factor_Q22           -0.1725     1.1228  -0.154   0.8781
Factor_Q23            1.1020     2.3820   0.463   0.6442
Factor_Q32           -0.6224     1.5315  -0.406   0.6850
Factor_Q33            1.2258     1.1328   1.082   0.2808
Factor_Q52           -7.1219     1.2311  -5.785 3.49e-08 ***
Factor_FTNDLow       10.0829     1.1251   8.962 6.15e-16 ***
Factor_FTNDModerate   0.1085     1.2784   0.085   0.9325
Factor_FTNDVery High  -4.6852     3.0864  -1.518   0.1309
Factor_FTNDVery Low    9.6898     1.4053   6.895 1.06e-10 ***
PSQI.SCORES           -0.4344     0.1769  -2.455   0.0151 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 5.808 on 167 degrees of freedom
  (6 observations deleted due to missingness)
Multiple R-squared:  0.5663,    Adjusted R-squared:  0.5377
F-statistic: 19.82 on 11 and 167 DF,  p-value: < 2.2e-16
```

Figure 3. Linear regression models - FTND

```
> lm(FTND.SCORES~PSQI.SCORES, DATAMT)

Call:
lm(formula = FTND.SCORES ~ PSQI.SCORES, data = DATAMT)

Coefficients:
(Intercept)  PSQI.SCORES
      3.723        0.115

> summary(lm(FTND.SCORES~PSQI.SCORES, DATAMT))

Call:
lm(formula = FTND.SCORES ~ PSQI.SCORES, data = DATAMT)

Residuals:
    Min      1Q  Median      3Q     Max
-4.9881 -1.2983  0.3568  1.4718  4.3568

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.72342    0.41450   8.983  3.2e-16 ***
PSQI.SCORES  0.11497    0.05618   2.047   0.0421 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.959 on 183 degrees of freedom
  (216 observations deleted due to missingness)
Multiple R-squared:  0.02238,   Adjusted R-squared:  0.01704
F-statistic: 4.189 on 1 and 183 DF,  p-value: 0.04212


> lm(FTND.SCORES~Factor_Q5, DATAMT)

Call:
lm(formula = FTND.SCORES ~ Factor_Q5, data = DATAMT)

Coefficients:
(Intercept)   Factor_Q52
      3.516        1.205

> summary(lm(FTND.SCORES~Factor_Q5, DATAMT))

Call:
lm(formula = FTND.SCORES ~ Factor_Q5, data = DATAMT)

Residuals:
    Min      1Q  Median      3Q     Max
-4.7208 -0.7208  0.2792  1.2792  4.2792

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.5161     0.3464  10.150  < 2e-16 ***
Factor_Q52    1.2047     0.3797   3.173  0.00177 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.929 on 183 degrees of freedom
  (216 observations deleted due to missingness)
Multiple R-squared:  0.05214,   Adjusted R-squared:  0.04696
F-statistic: 10.07 on 1 and 183 DF,  p-value: 0.001771


> lm(FTND.SCORES~Factor_Q1, DATAMT)

Call:
lm(formula = FTND.SCORES ~ Factor_Q1, data = DATAMT)

Coefficients:
(Intercept)   Factor_Q1M
      3.646        1.133

> summary(lm(FTND.SCORES~Factor_Q1, DATAMT))

Call:
lm(formula = FTND.SCORES ~ Factor_Q1, data = DATAMT)

Residuals:
    Min      1Q  Median      3Q     Max
-4.7786 -0.7786  0.2214  1.2214  4.2214

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.6458     0.2782  13.105  < 2e-16 ***
Factor_Q1M    1.1328     0.3252   3.483 0.000624 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.927 on 177 degrees of freedom
  (222 observations deleted due to missingness)
Multiple R-squared:  0.06415,   Adjusted R-squared:  0.05887
F-statistic: 12.13 on 1 and 177 DF,  p-value: 0.000624
```

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

Universidade Nova de Lisboa