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Association of Health Literacy with Demographic Features, Health-Related Behaviors, and Health Risk Indicators among Egyptian Adults: Online Cross-Sectional Study

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Association of health literacy with demographic features, health-related behaviors, and health risk indicators among Egyptian adults: online cross-sectional study

A Thesis Submitted by

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Declaration of Authorship

I, Rana Gamal Hassan, declare that this thesis titled, "Associations of Health literacy with demographic features, health-related behaviors, health risk indicators and health status among Egyptian adults: a cross-sectional study" and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
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Signed:
Rana Gamal

Date:
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Abstract

Health literacy is recognized as a significant determinant of health. Limited health literacy is a growing issue worldwide. It has a significant role facing the rising trends of non-communicable diseases (NCDs) through improving its modifiable risk factors. Therefore, studying the association between health literacy and different health-related behaviors is very important to guide both healthcare professionals and policy makers to set up the proper interventions. Our study aims to a) examine the health literacy levels among Egyptian adults, b) investigate the association of health literacy relative to socio-demographic features, health related behaviors, and self-reported health status. This is a cross-sectional study where convenient sample of 358 Egyptian adults living in Greater Cairo were contacted online to participate in a self-administered survey. Statistical analysis was used to estimate the odds ratios (OR) between levels of health literacy and demographic features, health risk behaviors, and health status using binary logistic regression. The results showed that limited health literacy reaches 52%. Males, participants with below average monthly income, and those with chronic diseases are more likely to have limited health literacy, while participants with healthcare background and those who use at most 1 source searching for healthcare information are less likely to have limited health literacy. Limited health literacy has also been associated with physical inactivity, higher perceived mental stress rate, and sleeping hours less than 7 hours per day. Finally, the knowledge score of the participants on the main risk factors related to the most common non-communicable diseases was positively correlated with their health literacy score. Limited health literacy is a prevalent problem in Egypt, and further longitudinal national research is warranted to better identify the magnitude of the problem and establish casual associations between health literacy and demographic and behavioral factors.

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List of Abbreviations

AHA	**American Heart Association**
AUDIT-C	**Alcohol Use Disorder Identification Test-concise**
BMI	**Body mass index**
CDC	**Centers for Disease Control and Prevention**
CHL	**Comprehensive Health Literacy**
COVID-19	**Cornavirus Disease 2019**
DALY	**Disability Adjusted Life Year**
FHL	**Functional Health Literacy**
GATS	**Global Adult Tobacco Survey**
HL	**Health Literacy**
HLS-EU	**European Health Literacy Survey**
IRB	**Institutional Review Board**
LMICs	**Low Middle-Income Countries**
NCDs	**Non-Communicable diseases**
WHO	**World Health Organization**

List of Symbols

a	Cronbach's alpha
r	correlation coefficient

Chapter 1

Introduction

1.1 Background and significance

Health literacy is recognized as a significant determinant of health (Nutbeam & Lloyd, 2020). It has been firstly introduced in the 1970s (Simonds et al, 1974), however the attention to the concept has been significantly increased in the last two decades given its noteworthy benefits in health promotion and public health. Health literacy is defined as the person's capacity to obtain, comprehend, appraise, and apply health information and services in order to make informed health-related decisions and improve quality of life (Liu et al, 2020; Sørensen et al., 2012). Health literacy involves two main domains: functional and comprehensive. Functional health literacy involves the ability of the person to read health-related information, while comprehensive health literacy means the ability of the person to access, understand, and apply health information in their everyday life through making decisions concerned with health promotion and disease prevention (Sørensen et al., 2012; Nutbeam, 2008).

As the level of health literacy goes from proficient or adequate to limited or inadequate, limited health literacy is found to be a growing issue globally that has influence on both individual and population level. Lower levels of health literacy have found to be related to worse mental and physical health outcomes, increased hospital admission rates, higher mortality rates, poor understanding of health messages, decreased utilization of preventive health services such as screening procedures and vaccination services, as well as less proactivity in making lifestyle

changes towards healthier behaviors (Berkman et al., 2011; Fabbri et al., 2020; Peltzer et al, 2020). Additionally, health literacy can be extremely critical in facing global health problems, for example COVID-19-pandemic. The results of recent studies have shown that lower levels of health literacy limit the understanding of COVID-19 in terms of the disease nature and symptoms, the adoption of the disease-related health protective measures, and the comprehension of the government's health-related messages (McCafferya et al., 2020; Li et al., 2021). Consequently, limited health literacy is found to be associated with increasing healthcare costs (Apfel et al., 2013). The results of a systemic review showed that the cost of limited health literacy on the individual level ranged from US $143 to 7,798 per year as insufficient health literacy leads to increased utilization of emergency services, increased hospitalization rate, and misuse or overuse of existing health services unnecessarily; meanwhile on health system level, it imposed additional costs equivalent to 3-5% of the total annual healthcare cost (Eichler, Wieser, & Brügger, 2009).

Health literacy has a significant role facing the rising trends of the different non-communicable diseases (NCDs). Globally, as the burden of disease is shifting from communicable to non-communicable diseases, four main groups of non-communicable diseases which are cardiovascular diseases, diabetes, cancer, and respiratory diseases place the greatest burden in terms of mortality and morbidity (Bennett et al., 2018; Murray et al., 2020). The burden distribution of the non-communicable disease is disproportionate as two thirds of the deaths caused by NCDs happen in low- and middle-income countries (World Health Organization, 2014). More than 80% of deaths-related to these diseases strongly attributes to modifiable risk factors mainly unhealthy diet, physical inactivity, smoking and alcohol use to which health literacy is also linked (Lim et al., 2012; World Health Organization, 2013). Most of these modifiable risk factors are not only limited to the four main groups of NCDs but also to brain-

related non-communicable diseases including mental health disorders (e.g. depression and anxiety) and neurological disorders (e.g. stroke and dementias) where a significant public health challenge is also represented. Neurological disorders are the second leading cause of death globally, while mental health disorders account for 7% of the global burden of disease in terms of DALYs as well as 19% of all years lived with disability (Carroll, 2019; Rehm and Shield , 2019). Lifestyle behaviors found to impact our cognitive functions and mental health however the public awareness is limited about it (Budin-Ljøsne et al., 2020; World Health Organization, 2019). In order to maintain optimal brain health, non-smoking, physical activity, healthy diet, and maintaining appropriate body mass index are recommended by the American Heart Association (AHA)/American Stroke Association (Gorelick et al., 2017).

The emerging research is supporting that health literacy enables people's day to day decisions and behaviors related to their health to prevent and manage chronic diseases (Aaby et al, 2017, Apfel et al., 2013; Juul, Rowlands & Maindal, 2018; Spronk et al, 2014). Given the global epidemiologic transition and the increased cost of healthcare, prevention should be the primary focus especially in LMICs where resources are constrained, and health systems are already starched as they are still somehow suffering some communicable diseases. That's why improving the levels of health literacy within a community can impose a positive shift in the health-related behaviors, and consequently decrease the incidence and/or limit the progression of many non-communicable diseases.

The latest national Egyptian demographic and health survey showed increasing prevalence of non-communicable disease especially hypertension and diabetes type II; It also reported extreme levels of obesity and tobacco use (Ministry of Health Egypt, 2015). We expect that inadequate or

limited Health Literacy will be significantly associated with such health risk behaviors, such as increasing BMI, smoking, physical inactivity, and worse health status in general. Given the limited healthcare capacity in Egypt as a developing country, understanding this association will help developing tailored health literacy interventions that focus on prevention of non-communicable diseases by mediating its modifiable risk factors.

1.2 Hypothesis and study objectives

Studying the association between health literacy and different health-related behaviors is very important in Egypt as it can eventually guide both healthcare professionals and policy makers to setup the proper interventions needed in favor of their citizens. This study aims to a) examine the health literacy levels among Egyptian adults from general population, b) investigate the association of health literacy relative to socio-demographic features, health related behaviors, self-reported health status and knowledge.

In line with the aims, hypotheses were induced as follows:

1) Health literacy will differ by sociodemographic variables, and 2) different health literacy is associated with major health-related behaviors and health risk indicators (smoking, alcohol consumption, physical activities, sleep, stress rate, and BMI as a proxy for obesity).

Chapter 2

Literature review

The growing research showed that limited health literacy is a common issue even in the developed countries. The prevalence of limited health literacy reaches 36% among adult population in the US (Kutner et al., 2006; Magnani et al., 2018), whereas it reaches almost 50% among the Europeans (Apfel et al., 2013). Studies regarding health literacy levels from developing countries are scarce. However, they are expected to have higher prevalence of limited health literacy given the lower economic status and education level because limited health literacy was found to follow a social gradient (Apfel et al., 2013). For example, a cross-sectional study from turkey revealed that 67% of the study sample had limited health literacy, while other study from Saudi Arabia showed that most of the adult population belonged to either basic or intermediate levels of health literacy (Abdel-Latif & Saad, 2019; Aygun & Cerim, 2021). In the Middle East region, the distribution of health literacy is close to the one found in the United States and Europe (Rikard et al., 2016; Sørensen et al., 2015).

In Egypt, health literacy is still an unrecognized concept, also little is known about its levels among the Egyptian societies. To our knowledge only four cross-sectional studies tackled the topic of health literacy in Egypt (Almaleh et al., 2017; Anwar et al., 2020; Mostafa et al., 2021; Rahman, 2014). One study focused on health literacy among elderly and its relation to their rate of hospitalization and quality of life (Rahman, 2014). While Mostafa et al. (2021) assessed the association between health literacy and anti-biotic use among non-medical students. The

remaining two studies, one focused on rural fishermen, while the other one sampled visitors form the out-patient clinics of Ain Shams hospital (Almaleh et al., 2017; Anwar et al., 2020). In all the studies, the results showed high percentages of limited health literacy ranged from 65% to 81%. Neither of the previous studies focused on general population nor examined the association between health literacy and health-related behaviors.

Generally, limited health literacy found to be significantly higher among people with lower education level, lower socio-economic status, older age, and those who live in rural residence, also females found to be more vulnerable to limited health literacy (Wikkeling-Scott et al., 2019). Most of the studies done in the region are cross-sectional studies that focus mainly on patient populations. However, there is emerging research exploring health literacy as an instrument to enhance public health.

Although the association between health literacy and healthy behaviors has been established, the found results varied across studies depending on the context (i.e. the country, the indicator) and the diverse methods used. Most of the studies showed a significant association of health literacy with obesity and physical activity. As the lower levels of health literacy are linked to higher BMI (Chrissini & Panagiotakos, 2021). On the other hand, few studies showed insignificant association with body weight (Enomoto et al., 2020; Liu et al., 2015; Moghaddam et al., 2019). Additionally, there are reviewed studies that associated adequate health literacy to positive dietary habits such as sufficient consumption of fruits and vegetables and lower intake of saturated fats (Zoellner et al., 2011; Taylor et al., 2019; Geboers et al., 2016). In a hybrid randomized controlled study, "SIPsmartER" a health literacy-based intervention managed to significantly decrease the participants' consumption of sugar-sweetened beverages (SSB) and BMI (Zoellner et al., 2016).

Relevant to physical activity, 15 out of 19 observational studies included in a recent comprehensive systematic review showed a significant positive association between health literacy and physical activity among adults, however, similar to obesity, few studies showed insignificant association in regard to physical activity (Buja et al., 2020). In the European health literacy survey, the frequency of physical activity, among other health behaviors, showed the strongest and most consistent association with health literacy (Apfel & Tsouros, 2013).

More discrepancies were found in the results on the association between health literacy and smoking. Health literacy was found to be associated with the smoking prevalence and adoption of preventative behaviors against smoking (Liu et al., 2015 ;Panahi et al., 2015; Panahi et al., 2021). Moreover, health literacy was considered as an independent risk factor for poor outcome of smoking cessation as well as smoking relapse especially among lower socioeconomic class (Stewart et al., 2014; Stewart et al., 2013), which made health literacy a critical factor to consider when developing smoking-targeted intervention. On the other hand, some studies did not show a significant association between health literacy and smoking (Reisi et al., 2014; Olisarova et al., 2021).

Moreover, few studies have been found to link mental stress as well as sleep behaviors significantly to health literacy. Different cognitive and behavioral strategies are needed to uphold proper sleep pattern and to manage mental stress on day-to-day basis, where health literacy can be interestingly helpful as it enhances people skills and knowledge to access and understand health-related information to make enlightened decisions regarding their health and boost their sense of self-efficacy (Hackney et al, 2008; Michou et al., 2021). In other words, it is harder for people with low health literacy levels to maintain good self-care behaviors in managing chronic

diseases and different health problems including sleep problems and mental health illnesses (Aaby et al, 2017, Apfel et al., 2013; Hackney et al, 2008; Jorm, 2012; Juul, Rowlands & Maindal, 2018; Skinner et al., 2003).

The heterogeneity in the results on the associations of health literacy with health behaviors and health risk indicators may come from the various methods used to either assess health literacy or health behaviors; also, the change of the context would influence the behavior in different ways. Thus, further country-specific research using standard measures is needed to understand its health literacy needs.

Chapter 3

Methodology

3.1 Study design, setting, and population

This is a cross-sectional study where a convenient sample of Egyptian adults. Our inclusion criteria were as Egyptian adults who aged 18-64 and live in Greater Cairo. The area of Greater Cairo is the largest metropolitan area in Egypt, it is a highly populated one with more than 22 million residents in 2023 as prospected by the United Nations (United Nations, 2022). Given the diversity and complexity of this area, we did not include any further governorates so we can better assess the needs of health literacy and focus our research efforts. The participants were contacted online via social media platforms (mainly Facebook and Whatsapp) to participate in a self-administered web-based survey. To cover as many of the existing diverse subgroups, we focused on using social networks groups, and our respondents were also asked to rotate the survey among their friends and relatives on social media platforms (snowballing approach). The number of survey questions and the subgroups included in the analysis were considered to determine the sample size.

Ethical clearance was obtained from the institutional review boards (IRB) at the American University in Cairo (AUC) (IRB case number: 2022-2023-071). Participants were informed by the study's nature, purpose, and procedures, also they were asked for their consent to be given online before taking the survey. Confidentiality and privacy of the participants' data were strictly maintained.

3.2 Data collection and tools

Data was collected from December 2022 till January 2023. The study survey was divided into

the following sections: 1) demographics, 2) health literacy, 3) health related behaviors and health risk indicators, 4) knowledge and attitude assessment, and 5) health condition and self-assessed health status.

Part1: Socio-demographic questionnaire (11 items)

The Survey will ask about demographic information such as gender, age, social status, education level, employment, income, residence area, body weight, height, and healthcare background of the participants.

Part2: The European Health Literacy Survey Questionnaire short version (HLS-EU-Q16 questionnaire) (16 items)

The Arabic version of the modified (HLS-EU-Q16) was used to assess comprehensive health literacy. It consists of 16 items taken from the longer European Health Literacy Survey Questionnaire original matrix-related version (HLS-EUQ47). Both versions were developed by the European Health Literacy consortium as a part of the European Health Literacy (HLS-EU) project. It covers the conceptual model of CHL proposed by Sorensen et al. by investigating the ability of individuals to access/obtain, understand, process, and use health information covering three main domains: healthcare, disease prevention, and health promotion. Valid answer categories were 'very easy', 'fairly easy', 'fairly difficult', and 'very difficult' with the option to give an answer of 'do not know' that was analyzed in the same way as not answering the question. The scoring consisted of dichotomizing the valid answer categories of the 16 items; both categories 'very easy' and 'fairly easy' got the value of 'one', while categories 'fairly difficult' and 'very difficult' got 'zero'. Only respondents with at least 14 answers were considered valid for having cumulative score. The respondent could score between 0 and 16 points. Then, participants' scores were categorized into 'sufficient', 'problematic', and 'inadequate' HL. Scores equal to or more than 13 denoted sufficient HL, scores from nine to 12 denoted problematic HL, and scores

less than or equal to eight denoted inadequate HL (Pelikan & Ganahl, 2017). For the analysis in our study, responses were dichotomized into sufficient and limited (problematic and inadequate).

Part3: health related behaviors and health risk indicators (13 items)

Questions on different health-related behavior and health risk indicators including obesity, smoking, alcohol consumption, sleeping hours, and physical activity were included in our questionnaire adopted from standard tools and previously used methods.

Self-reported height and weight were obtained to allow calculation of body mass index (BMI). BMI was regarded as a health risk indicator as a proxy for obesity, and it was classified as underweight (BMI < 18.5 kg/m2), normal (BMI 18.5–24.9 kg/m2), overweight (BMI 25–30 kg/m2), or obese (BMI ≥30 kg/m2).

As defined by the CDC, a smoker is the person who smoked at least 100 cigarettes (5 packs) during his or her lifetime. Smoking status was measured using basic questions from the global adult tobacco survey (GATS) (World Health Organization, & Centers for Disease Control, 2011). For analysis, responses were classified into three groups: current smokers, former daily smokers, and never smoked.

AUDIT-C (Alcohol Use Disorder Identification Test-concise) was used to screen for harmful alcohol consumption (Bush et al., 1998). It is a simple 3-item tool adopted from the 10-item AUDIT questionnaire which was developed by the WHO (World health organization, 2001). The AUDIT-C is scored on a scale of 0-12. Each AUDIT-C question has 5 answer choices valued from 0 points to 4 points. A score of 4 or more for men or 3 or more for women is considered positive for hazardous drinking.

Following the WHO (2010) global recommendation on physical activity, adults aged 18-64 years old should do at least 150 min of moderate-aerobic activity per week or 75 min of vigorous-

aerobic activity per week. Participants were asked how many days on which they do vigorous-intensity and moderate intensity activity per week, and on how much time they spent doing such activity per day. Only participants with responses meeting the WHO recommendations were considered physically active.

Participants were asked "on average how many hours do you sleep per day?" setting 7 hours as the recommended cutoff based on the consensus made by the American Academy of Sleep Medicine and Sleep Research Society that adults (18-60 years old) should sleep at least 7 hours per night to promote optimal health (Consensus Conference Panel et al., 2015). Self-reported sleep quality was also reported using a 5-point Likert scale question: In general, how would you rate your sleep quality? Would you say it's excellent, good, fair, poor, or very poor? In the analysis, poor and very poor responses considered poor sleep quality.

Additionally, Perceived stress rate was assessed using 5-point Likert scale where participants were asked: "From day to day, how often do you feel stressed?" 1-never, 2-rarely, 3-sometimes, 4-often, 5-very often/always (Michou et al., 2021). in the analysis the answers were dichotomized into normal (never, rarely, or sometimes) and above normal (often or very often).

Part 4: knowledge and attitude assessment (3 items)

The knowledge and attitude of the participants towards the risk factors associated with non-communicable diseases and brain health were assessed through simple questions with 5-point likert scale as used in previously used in peer-reviewed studies (Legesse et al, 2022; Rahamathulla, 2020; Budin-Ljøsne et al., 2020; Demaio et al., 2011).

Participants were also asked about their Health information seeking behavior. How often the participants are using different information sources like internet, tv and radio, health professionals and scientific articles will be reported (often/sometimes/seldom/very seldom). The source reported as often/sometimes will be counted for the participant (Lui et al., 2015). The

number of sources used is also important as the more sources the higher the likelihood of reaching relevant information.

Part 5: health condition and self-assessed health status (2 items)

Lastly, the presence of diagnosed chronic diseases were reported, also self-reported general health status was assessed using the commonly used question: *"in general How would you rate your current health?"* 5-point scale, ranging from excellent to very poor. (Subramanian, Huijts & Avendano, 2010; Ware & Gandek, 1998)

3.3 Testing phase

After the questionnaire was primarily developed, a testing phase was conducted with 11 participants to get feedback on administrative and practical senses. It took around 10 to 15 minutes to fill in the answers, and minor modifications were made according to the given feedback to ensure a full understanding of the questions.

3.4 Statistical analysis

The categorical variables were presented using percentages and the continuous variables using means and standard deviation. Chi-square tests were performed to test differences between of some demographic characteristics and health literacy groups. Cronbach's alpha coefficient was calculated as a measure of internal consistency reliability of the HLS-EU-Q16. Individual odds ratios (OR) were estimated between levels of health literacy (outcome variable) and demographic and socioeconomic measures, health risk behavior, and health status (exposure variables) using both univariable and multivariable multinomial logistic regression analyses compared to odds of adequate health literacy. Spearmen correlations were used to assess correlation between health literacy score and knowledge scores. A two-sided P-value < 0.05 was considered statistically significant. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software.

Chapter 4

Results

4.1 Distribution of demographic and socioeconomic characteristics:

Out of 411 responses collected only 358 were analyzed. 53 responses were excluded either for not meeting the demographic inclusion criteria (age 18-64, Egyptian nationality, residence in greater Cairo) or for having invalid health literacy score as previously explained Fig.1. A detailed description of the characteristics of our study sample is presented in Table.1. The age of our included sample (n= 358) ranged between 18 and 62 years old with a median age of 30 years old (mean= 32.7, S. E= 8.7). Female exceeded two thirds (71.2%, n= 255) of the total sample, while males was 28.8% (n= 103). In terms of the social status, half (50.6%, n= 181) of the respondents were never married, 44.7% (n= 160) were married, and 4.7% (n=17) were separated (divorced or widowed). Most of the respondents declared high education level, 69.8% (n=250) and 26.8% (n=96) had university degrees and post-graduate degrees respectively, where only 3.4% (n=12) had finished high school. 83.8% (n= 300) of the respondents were working, while 16.2% (n= 58) were not working or unpaid including students, housewives, retired, volunteers, and unemployed participants. As of the monthly income classification, 40.9% (n= 114) were classified as above average (>10,000 EGP), 24% (n= 67) were classified as average (7000-10,000 EGP), and 35.1% (n= 98) were classified as below average (< 7000 EGP). Worth to mention here that the pervious income classification was only applicable before the devaluation of the Egyptian pound which took place in March-April 2023. One half of the study population (54.5%, n= 195) did not have healthcare background, while the other half (45.5%, n= 163) declared having healthcare

background.

According to the demographic and socioeconomic characteristics, health literacy levels varied across subgroups (Table.1). However, it's distributed significantly only within gender, education, and healthcare background subgroups. Men and those without healthcare background had significantly lower levels of health literacy, while respondents who hold post graduate degrees have higher health literacy levels (p-value ≤0.05).

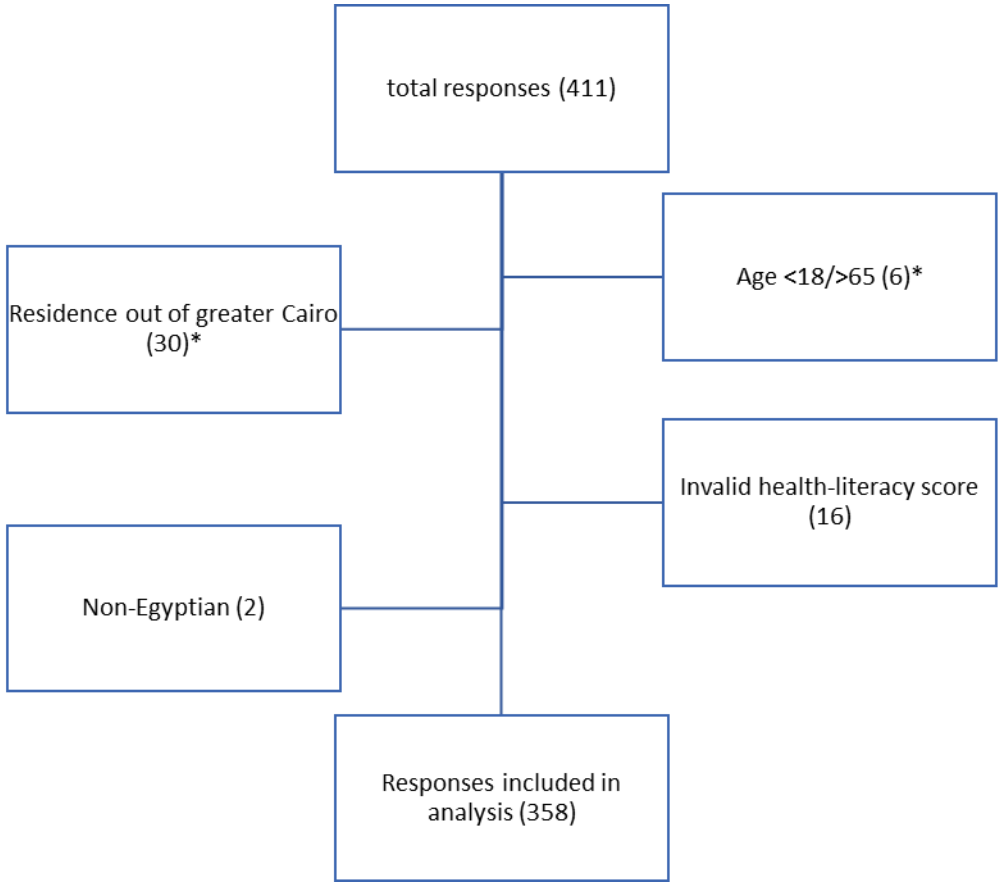

FIGURE 1: Reasons of case exclusion

Table 1: distribution of demographic and socioeconomic characteristics within sufficient and limited health literacy categories:

		Health literacy		Total	p-value
		Sufficient n= 173 (%)	**Limited** n= 185 (%)	n= 358 (%)	
Gender	Male	39 (37.9%)	64 (62.1%)	103 (28.8%)	≤0.05
	Female	134 (52.5%)	121 (47.5%)	255 (71.2%)	
Age	18-29	77 (47.2%)	86 (52.8%)	163 (45.5%)	*ns*
	30-39	59 (45.4%)	71 (54.6%)	130 (36.3%)	
	40-49	23 (60.5%)	15 (39.5)	38 (10.6%)	
	50-62	14 (51.9%)	13 (48.1%)	27 (7.5%)	
Social Status	No partner*	90 (45.5%)	108 (54.5%)	198 (55.3%)	*ns*
	Married	83 (51.9%)	77 (48.1%)	160 (44.7%)	
Education	High school	3 (25.0%)	9 (75.0%)	12 (3.4%)	≤0.05
	College	115 (46.0%)	135 (54.0%)	250 (69.8%)	
	Post-graduate	55 (57.3%)	41 (42.7%)	96 (26.8%)	
Employment	Not working**	27 (46.6%)	31 (53.4%)	58 (16.2%)	*ns*
	Working	146 (48.7%)	154 (51.3%)	300 (83.8%)	
Monthly income	Below average	43 (43.9%)	55 (56.1%)	98 (35.1%)	*ns*
	Average	29 (43.3%)	38 (56.7%)	67 (24.0%)	
	Above average	59 (51.8%)	55 (48.2%)	114 (40.9%)	
Healthcare background	No	73 (37.4%)	122 (62.6%)	195 (54.5%)	≤0.01
	Yes	100 (61.3%)	63 (38.7%)	163 (45.5%)	

*no partner subgroup included: never married, divorced, widowed, and others.
**not working subgroup included: not working, retired, students, housewives, and others.

4.2 Distribution of health literacy within the study sample

On the 16-item scale, the median health literacy score of our sample was 12 (Q1: 9, Q2: 12, Q3: 15) (Fig. 2). As previously described, the score of the HLS-EU-Q16 results in three subgroups: sufficient, problematic, and inadequate. Across our sample, almost half of our respondents (48.32%, n= 173) had sufficient health literacy level, approximately one third (32.4%, n= 116) had problematic health literacy level, while the remaining (19.27%, n= 69) had inadequate health literacy level. In our analysis, we combined the latest two as limited health literacy category (51.67%, n= 185) (Fig. 3). Within the categories of sufficient and limited, the median score of health literacy were 14.64 and 8.99 respectively. The overall Cronbach's alpha was 0.814 which indicates good internal consistency of HLS-EU-Q16 questionnaire, and within each of the healthcare, disease prevention, and health promotion domains acceptable internal consistency was found α= 0.657, α= 0.660, and α= 0.614 respectively.

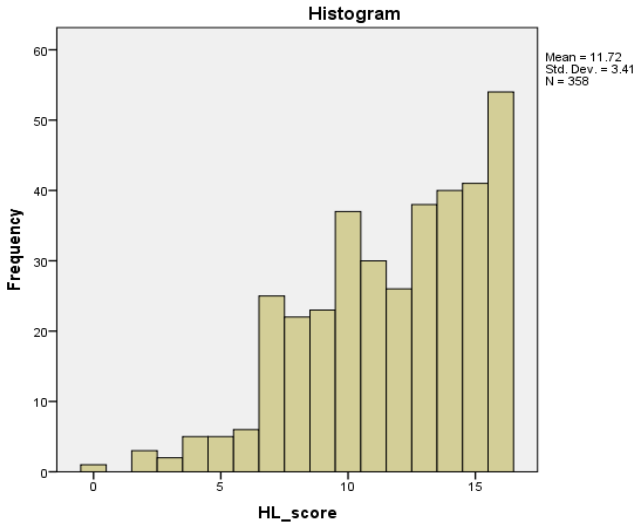

FIGURE 2: Histogram of health-literacy score distribution

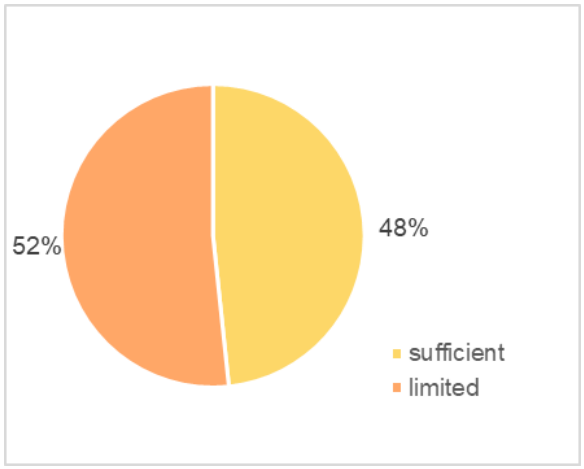

FIGURE 3: pie chart of health-literacy groups (%)

The distribution of responses to individual items in HLS-EU-Q16 is shown in Table 2. The items that had the highest frequency of perceived difficulty were "Find information on how to manage mental health problems like stress or depression?" (65.6%, n= 235) and "Judge if the information on health risks the media is reliable?" (50%, n= 179). On the other hand, the ones with least difficulty were "Understand your doctor's or pharmacist's instruction on how to take a prescribed medicine?" (3.4%, n= 12) And "Understand health warnings about behavior such as smoking, low physical activity and drinking too much?" (10.6%, n= 38).

Table 2: The distribution of responses to individual items in HLS-EU-Q16

HLS-EU-Q16 items	**easy/v.easy** Count (%)	**difficult/v.difficult** Count (%)	**I don't know Count** (%)
Q1: Find information on treatments of illnesses that concern you?	282 (78.8)	70 (19.6)	6 (1.7)
Q2: Find out where to get professional help when you are ill?	269 (75.1)	88 (24.6)	1 (0.3)
Q3: Understand what your doctor says to you?	315 (88.0)	43 (12.0)	0
Q4. Understand your doctor's or pharmacist's instruction on how to take a prescribed medicine?	346 (96.6)	12 (3.4)	0
Q5. Judge when you may need to get a second opinion from another doctor?	210 (58.7)	141 (39.4)	7 (2.0)
Q6. Use information the doctor gives you to make decisions about your illness?	266 (74.3)	89 (24.9)	3 (0.8)
Q7. Follow instructions from your doctor or pharmacist?	292 (81.6)	64 (17.9)	2 (0.6)
Q8. Find information on how to manage mental health problems like stress or depression?	123 (34.4)	223 (62.3)	12 (3.4)
Q9. Understand health warnings about behavior such as smoking, low physical activity and drinking too much?	320 (89.4)	36 (10.1)	2 (0.6)
Q10. Understand why you need health screenings?	287 (80.2)	71 (19.8)	0
Q11. Judge if the information on health risks the media is reliable?	179 (50.0)	174 (48.6)	5 (1.4)
Q12. Decide how you can protect yourself from illness based on information in the media?	197 (55.0)	155 (43.3)	6 (1.7)
Q13. Find out about activities that are good for your mental well-being?	273 (76.3)	83 (23.2)	2 (0.6)
Q14. Understand advice on health from family members or friends?	294 (82.1)	60 (16.8)	4 (1.1)
Q15. Understand information in the media on how to get healthier?	286 (79.9)	67 (18.7)	5 (1.4)
Q16. Judge which everyday behavior is related to your health?	257 (71.8)	101 (28.2)	0

4.3 Distribution of health behaviors, health risk indicators, and health status

The distribution of the health-related behaviors, health risk indicators, and health status among our sample are presented in Table.3. According to BMI classification by the WHO, more than half of our sample were either obese (n=79, 22.3%) or overweight (n=125, 35.2%). Additionally, almost one half of the respondents met the WHO recommendation for physical activity and were considered active (n=175, 49.3%), while the other half were inactive (n=180, 50.7%). Most of our study sample were declared to be non-smokers (n=293, 81.8%), meanwhile 12.8% (n= 46), were current smokers, and only 5.3% (n= 19) were former smokers. Only 2% (n=7) were classified as risky alcohol drinkers based on AUDIT-C score. Regarding sleep, more than half of the respondents (n= 213, 59.5%) declared to sleep 7 or more hours per day, however 12.3% (n=44) of the total sample ranked their sleep quality as very poor/poor. Additionally, half of the study sample reported experiencing stress as always/often (n=180, 50.3%). One third (n=135, 37.7%) used at least four sources while searching for health-related information, while one quarter used three sources (n=90, 25.1%). As health outcome, only 25.4% (n= 91) had one or more chronic disease and only 5.6% (n=20) assessed their general health as very poor/poor.

Across all health-related behaviors and health risk indicators, chi-square test showed that health literacy is distributed significantly different within the subgroups of mental stress, sleep hours (p-value < 0.05), and number of sources used (p-value < 0.01). On the other hand, no significant difference was found in the distribution across subgroups in terms of presence of chronic disease or self-assessed general health status.

Table 3: Distribution of health-related behaviors, health risk indicators, and health status

		Health literacy		Total	p-value
		Sufficient n= 173 (%)	**Limited** n= 185 (%)	n= 358 (%)	
Body mass index (BMI)*	Underweight	3 (50.0%)	3 (50.0%)	6 (1.7%)	*ns*
	Normal	72 (49.7%)	73 (50.3%)	145 (40.8%)	
	Overweight	54 (43.2%)	71 (56.8%)	125 (35.2%)	
	Obese	43 (54.4%)	36 (45.6%)	79 (22.3%)	
Alcohol drinking risk (AUDIT-C)	Low	171 (48.7%)	180 (51.3%)	351 (98.0%)	*ns*
	High	2 (28.6%)	5 (71.4%)	7 (2.0%)	
Smoking	Current Smoker	20 (43.5%)	26 (56.5%)	46 (12.8%)	*ns*
	Former somker	7 (36.8%)	12 (63.2%)	19 (5.3%)	
	Non-smoker	146 (49.8%)	147 (50.2%)	293 (81.8%)	
Physical activity*	Active	91 (52.0%)	84 (48.0%)	175 (49.3%)	*ns*
	Inactive	81 (45.0%)	99 (55.0%)	180 (50.7%)	
Sleep hours	>/= 7 hrs	112 (52.6%)	101 (47.4%)	213 (59.5%)	≤0.05
	< 7 hrs	61 (42.1%)	84 (57.9%)	145 (40.5%)	
Sleep quality	Good	149 (47.5%)	165 (52.5%)	314 (87.7%)	*ns*
	Poor	24 (54.5%)	20 (45.5%)	44 (12.3%)	
Stress rate	Always/often	76 (42.2%)	104 (57.8%)	180 (50.3%)	≤0.05
	Normal	97 (54.5%)	81 (45.5%)	178 (49.7%)	
Chronic diseases	Present	39 (42.9%)	52 (57.1%)	91 (25.4%)	*ns*
	Absent	134 (50.2%)	133 (49.8%)	267 (74.6%)	
Self-reported health Status	Poor	10 (50.0%)	10 (50.0%)	20 (5.6%)	*ns*
	Good	163 (48.2%)	175 (51.8%)	338 (94.4%)	
Number of sources used	0	2 (20%)	8 (80%)	10 (2.8%)	≤0.01
	1	14 (31.8%)	30 (68.2%)	44 (12.3%)	
	2	33 (41.8%)	46 (58.2%)	79 (22.1%)	
	3	50 (55.6%)	40 (44.4%)	90 (25.1%)	
	≥4	74 (54.8%)	61 (45.2%)	135 (37.7%)	

*some cases were missing

4.4 Associations of health literacy with demographic and socioeconomic characteristics

In Table.4, the results of univariate and multi-variate binary logistic regression where estimated odds ratio of having limited health literacy across subgroups were presented. In both univariate and multivariate analysis, males found to be significantly more likely to have limited health literacy rather than females (OR: 1.902, 95% CI: 1.048-3.450). The odds of limited health literacy significantly decreased with having healthcare background in both adjusted and unadjusted models (OR: 0.318, 95% CI: 0.192-0.528). While the unadjusted model revealed that respondents with post-graduate degrees were significantly less likely to have limited health literacy (OR: 0.248, 95% CI: 0.63-0.976), the adjusted model showed significant association with monthly income where limited health literacy increased with below average income (OR: 1.977, 95% CI: 1.022-3.823). No associations found with age, social status, and employment status.

4.5 Associations of health literacy with health behaviors, health risk indicators, and health status

Following up on health-related behaviors and health risk indicators in Table. 4, no associations of limited health literacy found with smoking, hazardous alcohol drinking, and BMI. However, significant associations were found with stress rate, sleeping hours, physical activity, number of sources used for looking up health-related information, presence of chronic diseases. In both unadjusted and adjusted models, the odds of limited health literacy increased with respondents who experience stress more often on daily basis (OR: 1.705, 95% CI: 1.043-2.786). Additionally, the adjusted model showed a significant association between limited health literacy and physical activity, where people who are inactive had higher risk for limited health literacy (OR: 1.868, 95% CI: 1.123-3.107). Likewise, respondents who sleep less than 7 hours had higher odds of having limited health literacy (OR: 1.815, 95% CI: 1.089-3.025). In comparison to respondents who use ≥ 4 sources searching for health-related information, although there is no

association found for limited health literacy with those use 2-3 sources, a strong significant association found with those who use ≤ 1 source in both adjusted and unadjusted models (OR: 2.369, 95% CI: 1.117- 5.025). Regarding health status, however no association was found with self-reported health status in both models, the adjusted model showed significant association with chronic disease, where people with one or more chronic disease are more likely to have limited health literacy (OR: 1.896, 95% CI: 1.069- 3.360).

Table 4: univariate and multivariate binary logistic regression presenting associations of limited health literacy

Indicator *(reference category)*		**Univariate/Unadjusted**		**Multivariate/Adjusted**	
		OR	95% C.I.	OR	95% C.I.
Gender *(Female)*	*Male*	1.817**	(1.138-2.902)	1.902*	(1.048-3.450)
Age *(< 40)*	*≥ 40*	1.525	(0.887-2.623)	1.911	(0.974-3.751)
Social status *(no partner)*	*Married*	.773	(0.509-1.174)	.689	(0.406-1.169)
Education *(high school)*	*Post graduate*	.248*	(0.063-0.976)	.356	(0.063-2.022)
	College	.391	(0.103-1.480)	.526	(0.099-2.809)
Employment *(not working)*	*Working*	.919	(0.523-1.614)	1.219	(0.591-2.516)
Income *(above average)*	*Average*	1.133	(0.694-1.850)	1.179	(0.669-2.078)
	Below average	1.372	(0.798-2.360)	1.962*	(1.013-3.798)
Healthcare background *(no)*	*yes*	.377**	(0.246-0.579)	.318**	(0.192-0.528)
BMI *(normal)*	*obese*	.816	(0.474-1.405)	.748	(0.386-1.451)
	overweight	1.281	(0.797-2.059)	1.612	(0.919-2.827)
Physical activity *(active)*	*inactive*	1.334	(0.880-2.022)	1.868**	(1.123-3.107)
Smoking *(non-smoker)*	current smoker	1.291	(0.690-2.415)	.789	(0.361-1.726)
	former smoker	1.703	(0.652-4.446)	1.486	(0.499-4.423)
Alcohol drinking risk *(low)*	high	2.375	(0.455-12.405)	2.756	(0.431-17.615)
Sleeping hours *(>/= 7 hrs)*	< 7 hrs	1.527*	(0.998-2.337)	1.815*	(1.089-3.025)
Sleep quality *(good)*	poor	.753	(0.399-1.418)	.538	(0.244-1.184)
Stress rate *(normal)*	always/often	1.639*	(1.079-2.488)	1.705*	(1.043-2.786)
Chronic diseases *(absent)*	present	1.343	(0.832-2.170)	1.896*	(1.069-3.360)
Self-reported health status *(good)*	poor	.931	(0.378-2.296)	.591	(0.195-1.788)
no. of sources used *(=/>4)*	0 or 1	2.881**	(1.466-5.661)	2.369*	(1.117-5.025)
	2 or 3	1.257	(0.799-1.979)	1.269	(0.759-2.121)

OR: odds Ratio. Note: OR with P-values (P ≤ 0.05) are flagged with star symbols (*), while OR with P-values (P ≤ 0.01) are flagged with double star symbols (**)

4.6 Correlation between health-literacy score and knowledge on health-related risk factors

As shown in Fig. 4 and 5, our study group included more respondents who are aware of the risk factors related to non-communicable diseases in comparison to those who are aware of those related to brain health, although some risk factors are related to both non-communicable disease and brain health. The health literacy score and scores from responses on risk factors knowledge were correlated using spearmen correlation analysis (Table 5). A significant positive yet weak correlation was found between health literacy scores and knowledge score on risk-factors related to non-communicable diseases (r= 0.114, p-value <0.05). Although a positive yet non-significant correlation was found between health literacy score and knowledge score on risk-factors related to brain-health, a moderate positive significant one was found between knowledge score on risk-factors related to brain-health and knowledge score on risk-factors related to non-communicable diseases (r= 0.307, p-value <0.01).

Table 5: Spearmen correlations between health literacy score and knowledge scores on health risk-factors

Variables	1	2	3
HL score	1.000		
Knowledge score (a)	.114 *	1.000	
Knowledge score (b)	.081	.307 **	1.000

Knowledge score (a): Knowledge score on risk factors related to Non-Communicable Diseases
Knowledge score (b): Knowledge score on risk factors related to Brain-health.
Note: r with P-values (P ≤ 0.05) are flagged with star symbols (*), while r with P-values (P ≤ 0.01) are flagged with double star symbols (**)

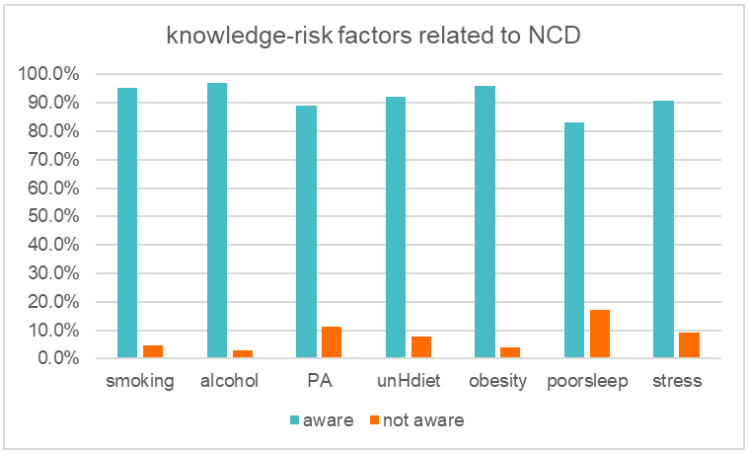

FIGURE 4: Knowledge on risk factors related to NCD.

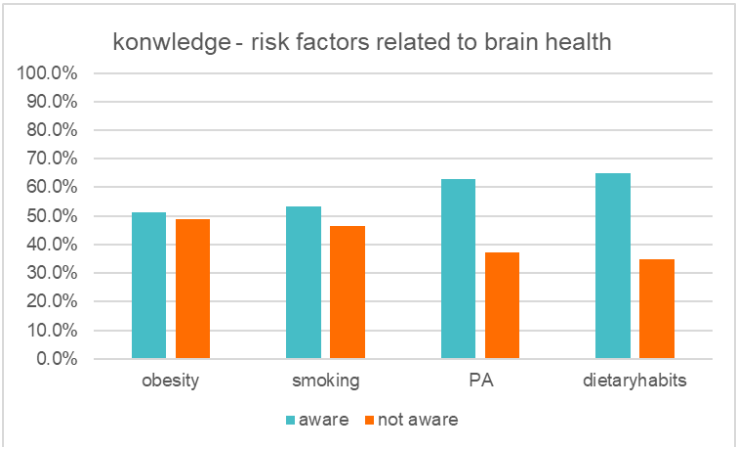

FIGURE 5: knowledge on risk factors related to brain-health.

Chapter 5

Discussion

5.1 Interpretations

Our study objective was to assess the level of limited health literacy among Egyptian adults living in the greater Cairo and its association with demographic socio-economic features, health-related behaviors, health risk indicators, and self-rated health status. As per our results, more than half of our study sample (52%) had limited health literacy. Among the demographic and socio-economic factors, gender, healthcare background, education and monthly income were significantly affecting the level of health literacy. In terms of health risk indicators and health-related behaviors, physical activity, sleeping hours and stress rate were found to affect health literacy significantly, but not BMI, smoking and alcohol consumption. Although self-rated general health literacy was not found to have an association with limited health literacy, the presence of one or more chronic disease was significantly associated. Additionally, as our study results showed a significant association between having sufficient health literacy level and using at least 3 sources when searching for health-related knowledge, a positive correlation between health literacy score and knowledge related to risk factors of non-communicable diseases.

The comparative results from the European health literacy survey, which was conducted in different 8 countries in Europe, showed that 47% of the population had limited health literacy (problematic and inadequate) which is somehow comparable to the results from our study in which limited health literacy reached 52% (Sørensen et al.,2015). Percentage of sufficient health literacy in the current study is higher in comparison to Egyptians studies done in the past. For

instance, one Egyptian study where comprehensive health literacy was similarly measured using HLS-EU-Q16, the percentage of limited health literacy among the outpatient-clinics' visitors (patients and companions) of the Ain Shams University Hospitals in Cairo reached 81%, which is interestingly much higher than our results (52%) (Almaleh et al., 2017). This can be explained by the difference in socio-economic features. In Almaleh et al. (2017), more than half of the study population (53.2%) had the highest education level lower than high school, accordingly we assume they belonged to lower socio-economic class. However, the highest education level among all our respondents was either high school or above, which reflects higher socio-economic level hence higher health literacy level.

To define the social subgroups who are more vulnerable to limited health literacy, we investigated gender, age, social status, education, employment status and income. Although gender in the European study was not as strong predictor of health literacy as it shown in ours, both results declared than men are more vulnerable for limited health literacy compared to women. This is also consistent with the results from Almaleh et al. (2017) on comprehensive health literacy. This could be because it is common for women to take the caregivers roles for their families in the Egyptian communities, that's why they frequently expose to health services and receive medical information regarding health promotion and disease prevention which build up to better comprehensive health literacy. On the other hand, Almaleh et al. (2017) also found that Egyptian females are paradoxically more common to have lower functional health literacy, which could be rooted to gender-based discrimination in education faced by women in developing countries especially in lower economic classes. Moreover, our study results endorse that limited health literacy follows social gradient for socio-economic status as per existing literature (Apfel & Tsouros, 2013). In our results, people who earn lower than the average monthly income were more likely to have limited health literacy after controlling for other

independent variables. Meanwhile for the highest education level achieved, only in the univariate model participants holding post-graduate degrees found to have significantly higher health literacy in comparison to those at the level of high school, however this effect was diluted after adjusting for confounders. As in our study group, the education levels were limited to high school, college degree, or post-graduate degree, however in other studies, where education was found to remain significant predictor of health literacy even after controlling for other variables, usually more lower levels of education were covered and consistently associated with limited health literacy (Almaleh et al., 2017; Levin-Zamir et al., 2016; Sørensen et al.,2015; Svendsen et al., 2020). Further longitudinal studies representing all possible educational levels in the Egyptian community is recommended to define and understand better the relation between health literacy and education as well as the pathways where both interact. Moreover, in our results, participants with healthcare background were found to significantly have higher health literacy levels. This may sound self-explained, however having healthcare background does not guarantee having sufficient health literacy levels in all cases (Rueda-Medina, 2020). In addition, the inclusion of this variable has its importance as a confounding factor in the analysis.

In Egypt, our study is the first one to assess the associations between health literacy and different health-related behaviors and health risk indicators including smoking, alcohol consumption, sleep, physical activity, obesity, and stress. Despite the heterogeneous results found in the existing literature on the association of health literacy with most of these factors, physical activity and obesity has the most consistent and strongest association with limited health literacy (Buja et al., 2020; Chrissini & Panagiotakos, 2021; Apfel & Tsouros, 2013). In alignment with the results from HLS-EU, our results showed that active people are significantly less likely to have limited health literacy after controlling for other socio-economic variables. This is because sufficient health literacy enriches people's skills and abilities to adopt healthier personal behaviors

(Nutbeam, 2008). Even though sufficient health literacy ensures proper access to health information that is crucial for adoption of healthy behaviors, but also other influencing factors should be considered (Berkman, 2011). In contrast to physical activity, we did not find significant association with BMI as a proxy for obesity. Although BMI has been widely used to assess body adiposity, it is not ideally to be solely used. Additionally, obesity is a complex problem with multi risk factors that are not limited to individual's behavior. That's why, this result cannot be conclusive and further research is needed that involve different methods to assess obesity and assess its related risk factors, so we can confidently answer if there are true association between health literacy and obesity in the Egyptian society.

Moreover, in alignment with the limited articles in the literature tackling the association between comprehensive health literacy with either sleep or stress, the current study showed that sleeping hours and perceived stress rate are strong significant predictors of limited health literacy (Aygun & Cerim, 2021; Hackney et al, 2008; Michou et al., 2021). As it is common that general population do not acknowledge the contribution of proper sleep to maintain good health, health literacy has an important role educating people and enhancing their skills to understand health information and enrich self-efficacy to eventually make informed decisions in favor of their health (Hackney et al, 2008). It has been established that it is more difficult for people with low health literacy to follow good self-care behaviors in different chronic illnesses which can similarly be the case with sleep problems (Aaby et al, 2017, Apfel et al., 2013; Hackney et al, 2008; Juul, Rowlands & Maindal, 2018; Spronk et al, 2014). Likewise mental stress is very common among the general population nowadays, and the one's capability of dealing with it has a significant effect on different health outcomes and sense of wellbeing. Although mental stress and some anxiety disorders can be easily treated, most of the affected people are neither likely to seek help nor comply to endorsed interventions (Bandelow et al., 2022; Coles & Coleman, 2010). This can be

especially interesting as finding information on mental health issues had the highest perceived difficulty (62.3%) among our study group. The inter-relation between limited health literacy and mental stress can go both way where limited health literacy can hinder one's ability to cope with psychological health issues, and it can even increase perceived stress levels, meanwhile it is possible that mental stress can hold back someone from improving their level of health literacy. Research has shown that individuals with lower health literacy are more likely to encounter negative feelings such as guilt that hinder them from expressing their difficulties in seeking and understanding health information (Diviani et al, 2015). Enhancing health knowledge by improving health literacy can help people deal better with increased mental stress or anxiety as it encourages treatment or help seeking behavior as well as adopting appropriate coping strategies that enhance both mental and physical health (Jorm, 2012; Skinner et al., 2003). Worth to mention here that it can be extra beneficial to consider the theories and models of behavior change such as Health Belief Model while designing, implementing and evaluating interventions that aim behavioral change.

In contrast to most results from existing literature, our results did not show significant correlation between health literacy and self-assessed general health status (Levin-Zamir et al, 2016; Liu et al.,2015; Sørensen et al., 2015, Svendsen et al., 2020). However, like the results of HLS-EU study as well as a Turkish study, a significant association was found with the presence of chronic diseases beyond demographic and behavioral factors where people with chronic disease are more likely to be with limited health literacy (Aygun & Cerim, 2021; Sørensen et al., 2015). The results from another Egyptian study, where older adults were targeted and a different health literacy tool was used, showed a significant association of health literacy with both physical and mental component of quality of life (Rahman, 2014). The relation between health literacy and health status is not fully understood. However, health literacy has found to be associated with higher

hospitalization rate, more frequent utilization of emergency care, less use of preventive healthcare services like screening and vaccination, lower knowledge of diseases, poorer understanding of health messages, poorer compliance to taking medications as well as less engagement in health promoting behaviors (Berkman et al., 2011b; Taggart et al., 2012). Moreover, it was proposed that limited health literacy involves a triple burden, whereas poor people are more prone to have poor health status as well as limited health literacy (Svendsen et al., 2020). Nevertheless, the exact pathways that explain the relation between health literacy and general health status as well as other health outcomes need further research including larger sample size, also using more objective tools to measure health status is warranted to uncover and further understand the relationship between health literacy and health status.

5.2 Strengths and Limitations

This study is contributing to the growing research worldwide tackling health literacy as a key determinant of health. This can be especially significant in Egypt where knowledge on health literacy is scarce in general and especially in relationship to health-related behaviors, health risk indicators and health status. Health literacy was measured using an internationally used validated tool which facilitates comparing results from different countries, also HLS-EU-Q16 is short and very easy to administer. On the other hand, a minimum level of literacy is needed to enable self-reporting, especially online, therefore we assume that some vulnerable subgroups were not included because of lacking the skills needed to participate. Additionally, self-reporting can contribute to overestimation of health literacy scores as it was found that web-based reporting can result in higher health literacy scores than the ones generated based on interviews (Pieschl, 2021; Svendsen et al., 2020). In general, self-reporting questionnaires may involve misunderstanding of some questions by the participants as well as reporting results that reflect a better situation than their real one to feel socially more likable. To promote honesty and response

accuracy, the survey was completely anonymous, and we declared in the informed consent that absolute data privacy is guaranteed. Nevertheless, it is recommended for future research to use different strategies in data collection to ensure data accuracy.

Moreover, this study involves some limitations that need to be taken into consideration in future research. The nature of the study as cross-sectional hinders the establishment of casual associations between health literacy and demographic and behavioral variables, that's why further longitudinal studies are needed to overcome this issue. Although our study sample was sufficient to satisfy the study objectives, it is considered small to cover the diverse subgroups existing in the targeted Egyptian community which hinders the generalizability of the results. In addition, having the survey exclusively online limited its reach to those with internet access only. However, it was reported in 2021 that 70% of the Egyptian population aged 13 and above have social media accounts especially Facebook taking into consideration that our main interest is studying the psychometric features of the Egyptians regarding health literacy and its association with health behaviors. To improve the response rate, compensation can be offered to boost self-motivation but due to lack of resources this was not applicable.

5.3 Implications

The first step to solve a problem is defining it and its dimensions. Although the results of this could not be generalized to Egyptian population, it presents an initial screening of the status quo. The reported high percentage of limited health literacy highlights the need for implementing national research project focusing on health literacy in Egypt. Taking into consideration the fact that most of our study group belonged to good education level and earned average/above average monthly income, we assume worse health literacy levels among subgroups with lower education and income. Hence, future research using random sampling and representing all existing socio-economic subgroups in the community is warranted.

Our study results support the need to improve health literacy levels across our community, and to do so focused interventions should be applied. Most importantly, to approach the issue of health literacy holistically as a multi-disciplinary whole-society issue where multiple stakeholders are involved. These stakeholders include but are not limited to individuals or general-public, policy makers, healthcare professionals, education systems, and community-based organizations. One recommended health literacy invention is using plain language in communicating health information which ensures recipients completely understand the carried messages from the first time (Apfel & Tsouros, 2013). Delivering profound and clear health messages is mandatory to increase health literacy levels, messages content and delivery channels should be sensitive to diversity and able to reach vulnerable groups. Other interventions include building the capacity of healthcare providers on how to communicate health information and deal with people with limited health literacy, incorporating important health topics in educational programs, increasing awareness on available preventive services, and investing in health literacy-related research. Enhancing health literacy levels can improve self-management skills, patients' compliance to treatment plans, and utilization of preventive services like screenings and vaccinations, meanwhile it can decrease hospitalization rate, emergency department visits, and healthcare costs (Berkman et al., 2011).

Chapter 6

Conclusion

Although health literacy is an important determinant of health, its importance is somewhat overlooked in Egypt. Assessing the levels of health literacy among the Egyptian communities, defining the most vulnerable groups to limited health literacy, and further understanding its association with demographic features, health-related behaviors, health risk indicators, and health outcomes can be very beneficial for a developing country like Egypt where healthcare systems are truly overwhelmed. Improving health literacy levels through country-specific interventions can improve the outcome of many non-communicable diseases such cardiovascular diseases and diabetes, which impose the greatest burden on healthcare systems, as well as foster its prevention by mediating its modifiable risk factors. For example, based on the results generated from our study to develop health literacy interventions in the same context, it needs to be sensitive to high-risk groups like males and those with low monthly income. It should also focus on certain topics which are found to impact the level of health literacy such as physical activity, mental health, and sleep behaviors.

The results of our study are positively supporting our hypothesis that limited health literacy can be very prevalent in Egypt even among the well-educated communities. Obviously, males and people with monthly income below average are more likely to have limited health literacy. Participants with healthcare background and those who use at least 2 sources searching for healthcare information are less likely to have limited health literacy. Additionally, limited health literacy has also been associated with physical inactivity, higher perceived stress rate, and less

sleeping hours, but not with smoking, drinking alcohol, and obesity. Although self-reported general health status was not associated with limited health literacy, those with chronic diseases were found to be at higher risk for lower health literacy levels. Finally, the knowledge score of the participants on the main risk factors related to the most common non-communicable diseases was positively correlated with their health literacy score, which reflects the potential benefits of improving the levels of health literacy in favor of health promotion and disease prevention.

This study is an important step in bringing up health literacy as an important topic to the Egyptian healthcare agenda. As the findings of our study present a kind of wide preliminary assessment of the health literacy levels and its significance, it calls attention of policymakers and healthcare professionals that country-tailored health literacy interventions and precautions are needed to enhance the satisfaction of the people's needs with the offered healthcare services and minimize existing health disparities. Additionally, this study can be a basis for a further long-term and national scale research from which more accurate estimation of health literacy level can be generated, also better identification of the vulnerable subgroups to limited health literacy can be made to ensure adopting healthcare services accordingly. The associations of health literacy with the different health-related behaviors and health risk indicators need to be studied further across different Egyptian communities aiming to establish more profound casual associations. We assume this study will resonate a fruitful discussion around health literacy in Egypt and its multi-facets significance in public health and health promotion.

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