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Role of Electronic Health Literacy in Predicting Health-Promoting Lifestyle Behaviors in College Students

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ABSTRACT

Aims This study aimed to investigate the role of electronic health literacy in the adoption of health-promoting lifestyle behaviors among students at Qazvin University of Medical Sciences in Iran.

Instrument & Methods In this cross-sectional study, 376 students were selected in 2023-2024 using proportionate stratified sampling. Participants completed a demographic characteristics checklist, the Electronic Health Literacy Scale, and the Health-Promoting Lifestyle Profile II. Data were analyzed using SPSS 22, employing independent t-tests, Pearson's correlation coefficients, and multiple regression analysis.

Findings Of the 376 participants, 79.78% were under 22 years of age. The mean total health-promoting lifestyle behavior and electronic health literacy scores were 127.50±18.80 and 25.04±5.63, respectively. The highest scores among the health-promoting lifestyle behavior dimensions were observed in spiritual growth and self-actualization, while the lowest was in physical activity. A significant relationship was found between electronic health literacy and students' health-promoting lifestyle behavior. Age, gender, economic status, place of residence, and electronic health literacy together explained 32% of the variance in nutrition (R^2=0.235), 26% in interpersonal relationships (R^2=0.261), 20% in spiritual growth (R^2=0.202), 18% in health responsibility (R^2=0.183), 16% in stress management (R^2=0.162), and 11% in physical activity (R^2=0.115).

Conclusion Students have moderate mean lifestyle scores on both the Electronic Health Literacy Scale and health-promoting lifestyle behaviors.

Keywords Student; Health Promoting Behaviors; Health Literacy; eHealth; Lifestyle

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Introduction

With the rapid development of information and communication technologies in the Fourth Industrial Revolution (the digital revolution), individuals have become increasingly interested in managing their health by acquiring and utilizing health information from various sources [1].

Among these, the Internet has emerged as a primary source of health-related information [2], enabling users to acquire the knowledge needed to improve personal health and prevent disease [3]. Various groups—including university and school students, as well as patients—commonly use the Internet to search for information and make health-related decisions [4]. The academic community also has broad access to scientific and medical websites, as well as national and international databases, and remains highly dependent on the Internet for these activities. In this context, an individual's ability to find, evaluate, and utilize web-based health information is influenced by their electronic health literacy [5].

Despite the many advantages of using the Internet to deliver health services, it has not yet had a significant impact on Iranian society, as many physicians and patients continue to prefer traditional methods for diagnosing diseases and prescribing drugs. This preference can be attributed to a lack of proficiency in using information technology for health maintenance, which requires skills, such as reading, computer use, information seeking, understanding health information, and applying it [6].

Health literacy is an important issue in public health and has received increasing attention [7]. Adequate health literacy among individuals leads to outcomes such as increased patient empowerment, informed decision-making, reduced health risks, improved disease prevention, increased safety, better quality of life, and higher-quality care [8]. Electronic health literacy (eHealth literacy) is defined as the ability to find, understand, and evaluate health-related information from electronic sources and to use this information to identify or solve a health problem [9]. Acquiring eHealth literacy requires a combination of computer literacy, information literacy, media literacy, health literacy, and Internet-use skills [10]. Individuals with higher levels of eHealth literacy are not only more likely to use the Internet to find answers to health-related questions but also more capable of understanding the information they find, verifying its accuracy, and using it to promote health-related behaviors [11]. In the context of eHealth literacy, studies among university students have shown that eHealth literacy is positively associated with health-promoting lifestyle behaviors (HPLBs), including healthy eating, exercise, not smoking, and adequate sleep [12, 13].

An HPLB is considered an important strategy for achieving overall public health [14]. Pender's Health Promotion Model defines a health-promoting lifestyle as any set of activities performed to increase or maintain an individual's or group's level of health and self-actualization [15]. This lifestyle encompasses dimensions such as health responsibility, spiritual growth, physical activity, nutrition, interpersonal relations, and stress management [16]. Adopting health-promoting behaviors can significantly improve individuals' health and productivity [17].

According to a World Health Organization statement at the first Global Conference on Healthy Lifestyles in Moscow, 60% of global mortality and 80% of mortality in developing countries are attributable to unhealthy lifestyles, and these figures are projected to rise to 75% by 2030 [8]. Studies have shown that students are more likely to engage in behaviors that jeopardize their health, such as physical inactivity, unhealthy diet, alcohol consumption, and smoking [18, 19]. Because lifestyle habits become difficult to change after adulthood and university is considered the last opportunity for significant behavioral development and learning, adopting a healthy lifestyle during this period can lay the foundation for better health in later life by reducing the risk of adverse health outcomes and delaying the onset of chronic diseases [20].

In this context, Rathnayake and Senevirathna [21] and Park and Lee [3] assessed the eHealth literacy levels of nursing students in Sri Lanka and South Korea, respectively. They found that these nursing students lack sufficient eHealth literacy and concluded that improving it is necessary, requiring measures such as curricular changes and enhanced information technology resources in educational settings.

Similarly, Cho *et al.* [22] examined the relationship between eHealth literacy and HPLB among hospital nurses in South Korea and found that nurses with higher eHealth literacy exhibit significantly more HPLB. A study in Iran also showed that eHealth literacy significantly predicts engagement in health-promoting behaviors among university students [8].

Thus, students with higher levels of eHealth literacy are more likely to engage in healthy behaviors [23]. Health knowledge depends on health literacy, which has been recognized as a public health goal for the twenty-first century. The advent of the Internet has increasingly transformed the health information landscape. Therefore, examining how eHealth literacy influences HPLB is essential [11].

This study aimed to investigate the role of eHealth literacy in the adoption of HPLB among students at Qazvin University of Medical Sciences.

Instrument and Methods

Design and participants

This cross-sectional descriptive-analytical study was conducted from October 2023 to June 2024 among 376 students enrolled at Qazvin University of Medical Sciences in northwestern Iran. Participants were selected from all faculties (Health, Paramedical Sciences, Nursing and Midwifery, Medicine, and

Dentistry) using proportionate stratified sampling, accounting for the number of students in each faculty. The required sample size was calculated using Cochran's formula, with a 5% margin of error, yielding a minimum of 342 participants. Considering a 10% attrition rate, the final sample size was determined to be 376 students.

$$n = \frac{\frac{z^2pq}{d^2}}{1 + \frac{1}{N}\left[\frac{z^2pq}{d^2} - 1\right]}$$

The inclusion criteria were being enrolled as a student at the time of data collection, willingness to participate in the study, and having completed at least one academic semester in the relevant faculty. Those with incomplete questionnaire responses were excluded.

Instrument

The data collection instrument was a questionnaire consisting of three main sections. Section 1 concerned the demographic characteristics of participants, including gender, age, accommodation, student job, father's education, mother's education, father's job, mother's job, medical university field, self-reported health, and economic status.

Section 2 was the Electronic Health Literacy Scale (eHEALS), originally developed by Norman and Skinner [9], consisting of eight items rated on a five-point Likert scale (very poor, poor, fair, good, and very good), corresponding to scores ranging from 1 to 5. A higher mean score indicates a higher level of eHealth literacy, with total possible scores ranging from 8 to 40. The validity and reliability of the Persian version of this questionnaire were established by Bazm *et al.* [24], who translated it and conducted a psychometric evaluation. The instrument demonstrated satisfactory internal consistency (Cronbach's α=0.88; p<0.001) and test-retest reliability (r=0.96; p<0.001).

Section 3 was the Health-Promoting Lifestyle Profile II (HPLP-II), developed by Walker *et al.* [14], which measures the extent to which individuals engage in health-promoting behaviors. The Persian translation and psychometric validation were conducted by Mohammadi Zeidi *et al.* [25]. The questionnaire contains 52 items across six dimensions, including health responsibility (9 items), physical activity (8 items), nutrition (9 items), spiritual growth (9 items), interpersonal relations (9 items), and stress management (8 items). Items are rated on a four-point Likert scale (1: never; 2: sometimes; 3: often; 4: routinely), with a total score range from 52 to 208. Higher mean scores represent more frequent engagement in health-promoting behaviors. Walker *et al.* reported a Cronbach's alpha of 0.94 for the total scale, with subscales ranging from 0.79 to 0.94. The Persian version demonstrated a Cronbach's alpha of 0.82 for the total scale and values ranging from 0.64 to 0.91 for the subscales [25].

Additionally, the reliability of the questionnaire was evaluated using internal consistency (Cronbach's alpha) in a sample of 30 participants, yielding reliability coefficients of 0.86 for the eHEALS and 0.91 for the HPLP-II subscales.

Data collection

For data collection, the researchers approached the selected students in person. After introducing themselves and explaining the study objectives, participants were assured that their information would remain strictly confidential and that the results would be used solely in aggregate form within the research project. Participation was entirely voluntary and based on informed consent.

Data analysis

Data were analyzed using SPSS 22. The Kolmogorov-Smirnov test was used to assess the normality of the data distribution. Independent t-tests were applied to compare mean values between groups, Pearson's correlation coefficient was used to examine associations between parameters, and multiple regression analysis was performed to predict HPLB.

Findings

Among the 376 students, 61.44% were female, and 79.78% were under 22 years old. Additionally, 46.01% of participants reported their health status as good.

There was a statistically significant relationship between eHEALS scores and gender, place of residence, faculty, self-reported health status, and economic status (p<0.05). Moreover, gender, place of residence, faculty, father's occupation, self-reported health status, and economic status were significantly associated with HPLB scores (p<0.05; Table 1).

The mean HPLB score was 127.5±3.88, indicating a moderate level. The highest mean score among HPLB dimensions was for spiritual growth (23.61±4.39), while the lowest was for physical activity (18.08±3.80). The mean eHEALS score among students was 25.04±5.63. The mean value for individual items ranged from 2.88 to 3.22, with the lowest score recorded for the item: "I know what health resources are available on the Internet" (Table 2).

There were statistically significant and positive correlations among the HPLB dimensions (p<0.01). Additionally, there was a significant positive correlation between eHEALS and each HPLB dimension: health responsibility (r=0.39), spiritual growth (r=0.39), physical activity (r=0.34), nutrition (r=0.4), interpersonal relationships (r=0.41), and stress management (r=0.38; p<0.01 for all; Table 3).

Multiple regression analysis demonstrated that age, gender, economic status, place of residence, and eHEALS together explained 32% of the variance in nutrition (R^2=0.235; p=0.001), 26% in interpersonal

relationships (R^2=0.261; p=0.001), 20% in spiritual growth (R^2= 0.202; p=0.001), 18% in health responsibility (R^2=0.183; p=0.001), 16% in stress management (R^2=0.162; p=0.001), and 11% in physical activity (R^2=0.115; p=0.001). Furthermore, eHEALS predicted all six HPLB dimensions, such that a one standard deviation increase in eHEALS corresponded to increases of 0.32, 0.34, 0.34, 0.39, 0.35, and 0.30 standard deviations in nutrition, interpersonal relationships, spiritual growth, health responsibility, stress management, and physical activity scores, respectively (Table 4).

Table 1. Comparison of eHealth Literacy Scale and Health-Promoting Lifestyle Profile II Scores across students' demographic characteristics (n=376)

Parameter		Frequency	eHEALS	HPLP-II	p-Value*	p-Value**
Gender	Male	145	24.08±5.67	123.40±18.76	0.009	0.001
	Female	231	25.64±5.53	129.96±18.41		
Age (year)	<22	300	24.82±5.51	128.03±19.43	0.137	0.288
	>22	76	25.90±6.05	125.46±16.01		
Accommodation	Dormitory	235	24.23±5.52	125.07±18.36	0.0001	0.001
	Non-dormitory	141	26.37±5.58	131.48±18.87		
Student's job	Unemployment	288	25.17±5.64	127.93±19.15	0.417	0.665
	Part-time	70	24.90±6.02	126.65±17.88		
	Full-time	18	23.39±5.62	124.28±17.01		
Father's education	Below diploma	36	23.69±6.25	128.81±17.53	0.111	0.359
	Diploma	120	24.57±5.54	125.49±19.05		
	University	220	25.51±5.53	128.41±18.85		
Mother's education	Below diploma	56	23.37±6.40	123.27±17.04	0.70	0.058
	Diploma	180	25.40±5.29	126.66±18.81		
	University	140	25.17±5.69	130.13±19.11		
Father's job	Unemployment	12	26.67±6.03	130.75±26.24	0.258	0.008
	Farmer	42	23.57±5.76	121.83±18.15		
	Governmental	217	25.14±5.68	126.15±18.65		
	Non-governmental	105	25.22±5.39	132.13±17.56		
Mother's job	Unemployment	213	24.44±5.44	126.68±20.40	0.90	0.576
	Farmer	7	27.71±5.43	129.00±19.19		
	Governmental	129	25.65±6.02	127.86±17.28		
	Non-governmental	27	26.11±4.73	131.92±2.56		
Medical university field	Health	66	26.68±5.96	134.03±20.40	0.0001	0.0001
	Medical & dentistry	188	24.91±4.70	130.45±15.10		
	Paramedical	49	26.65±5.65	120.71±18.86		
	Nursing & midwifery	73	22.78±6.71	118.10±21.45		
Health self-report	Too week	2	13.00±0.00	91.00±0.00	0.0001	0.0001
	Week	15	22.00±7.70	121.93±26.25		
	Moderate	117	23.26±5.35	119.38±16.74		
	Good	173	26.06±5.30	128.68±15.41		
	Very good	64	26.72±4.95	141.64±19.42		
Economic status	Very week	6	20.83±8.93	118.17±29.62	0.0001	0.0001
	Week	46	22.19±5.24	117.64±19.46		
	Moderate	172	24.59±5.49	124.68±15.24		
	Good	133	26.08±5.04	133.09±18.42		
	Very well	19	29.95±5.97	140.10±26.62		

*eHEALS: eHealth Literacy Scale; **Health-Promoting Lifestyle Profile II (HPLP-II)

Table 2. Mean scores of the Health-Promoting Lifestyle Profile II (HPLP-II) and Electronic Health Literacy Scale (eHEALS)

Parameter		Values
Health-promoting lifestyle behavior dimensions (HPLP-II)	Nutrition	22.17±3.88
	Physical activity	18.08±3.80
	Health responsibility	20.49±4.03
	Stress management	20.27±3.77
	Interpersonal relationship	22.54±4.38
	Spiritual growth	23.61±4.39
	Total score	127.50±18.80
Electronic Health Literacy Scale (eHEALS)	I know what health resources are available on the Internet	2.88±1.00
	I know where to find helpful health resources on the Internet	3.16±0.93
	I know how to find helpful health resources on the Internet	3.20±1.04
	I know how to use the Internet to answer my questions about health	3.22±0.95
	I know how to use the health information I find on the Internet to help me	3.16±0.96
	I have the skills I need to evaluate the health resources I find on the Internet	3.18±0.94
	I can tell high-quality health resources from low-quality health resources on the Internet	3.13±1.02
	I feel confident in using information from the Internet to make health decisions	3.11±1.05
	Total score	25.04±5.63

Table 3. Correlations between Electronic Health Literacy Scale (eHEALS) scores and dimensions of health-promoting lifestyle behaviors

Parameter	eHEALS score	7	6	5	4	3	2	1
1. Nutrition	0.4	0.79	0.53	0.6	0.53	0.58	0.5	1
2. Physical activity	0.34	0.7	0.39	0.32	0.53	0.6	1	
3. Health responsibility	0.39	0.76	0.45	0.47	0.48	1		
4. Stress management	0.38	0.82	0.73	0.64	1			
5. Interpersonal relationship	0.41	0.8	0.68	1				
6. Spiritual growth	0.39	0.81	1					
7. Total HPLB	0.48	1						
eHEALS score	1							

Correlations are significant at 0.01.

Table 4. Multiple regression analysis predicting health-promoting lifestyle behavior dimensions from demographic characteristics and Electronic Health Literacy Scale (eHEALS) Scores

HPLB dimensions	Regression parameters	Age	Gender	Accommodation	Economic status	eHEALS score	R	R^2	F
Nutrition	B	-0.11	0.95	1.08	0.81	0.22	0.484	0.235	16.592
	β	-0.07	0.12	0.14	0.17	0.32			
	t	-1.5	2.5	2.9	3.4	6.5			
	p-Value	0.15	0.01	0.004	0.001	0.001			
Physical activity	B	-0.05	0.12	0.08	0.54	0.21	0.356	0.115	10.733
	β	-0.03	0.002	0.01	0.11	0.30			
	t	-0.63	0.04	0.21	2.19	5.83			
	p-Value	0.53	0.97	0.83	0.03	0.001			
Health responsibility	B	-0.13	0.104	0.62	0.53	0.28	0.427	0.183	16.49
	β	-0.07	0.03	0.07	0.11	0.39			
	t	-1.54	2.61	1.52	2.12	7.11			
	p-Value	0.12	0.79	0.13	0.04	0.001			
Stress management	B	-0.04	0.67	0.38	0.20	0.23	0.402	0.162	14.29
	β	-0.02	0.08	0.04	0.04	0.35			
	t	-0.54	1.79	0.99	0.85	6.92			
	p-Value	0.58	0.07	0.32	0.39	0.001			
Interpersonal relationship	B	-0.23	1.85	-0.25	0.96	0.27	0.511	0.261	25.97
	β	-0.12	0.20	-0.02	0.17	0.34			
	t	-2.77	4.49	-0.60	3.73	7.22			
	p-Value	0.006	0.001	0.54	0.001	0.001			
Spiritual growth	B	-0.20	0.76	0.58	0.71	0.26	0.499	0.202	18.69
	β	-0.11	0.08	0.06	0.13	0.34			
	t	-2.32	1.79	1.34	2.65	6.89			
	p-Value	0.02	0.07	0.18	0.001	0.001			

Discussion

This study assessed the role of eHealth literacy in the adoption of HPLB among students at Qazvin University of Medical Sciences. Students had a moderate ability to use electronic technologies to search for and access essential health-related information. This level was relatively similar to findings from other studies in Iran, such as Dashti *et al.* [26] and Isazadeh *et al.* [6], and in Japan by Tsukahara *et al.* [27]. According to Kim & Oh [1], information-seeking is the most common purpose for Internet use, accounting for 89.1% of total usage. Consequently, students tend to utilize the Internet to acquire both basic and advanced health information.

The HPLB score was in the moderate range among students at Qazvin University of Medical Sciences, consistent with findings by Zehni & Rokhzadi [28], Saadatmajd *et al.* [29], and Peker & Bermek [30], who reported moderate lifestyle scores among the majority of medical students. This may be attributed to the relatively similar circumstances of students, including age group, enrollment in health-related disciplines, a high proportion residing in dormitories, and adherence to shared regulations governing their living conditions.

The prevalence of moderate lifestyle scores underscores the need for targeted interventions to promote healthy, health-oriented lifestyles among students. In terms of HPLB dimensions, students had the highest scores in spiritual growth, a finding consistent with several national and international studies, including those by Al-Momani [31] and Peker & Bermek [30]. This may be due to the influence of Islamic values, the emphasis on spiritual care by university authorities, and the promotion of spiritual and cultural environments, which collectively contribute to higher spiritual health among students. Spirituality fosters a sense of meaning and purpose in life and a belief in a higher power, with potential positive effects on both mental and physical health. Fartookzadeh *et al.* emphasize the deep link between the Iranian-Islamic lifestyle and the spiritual dimension of society [32]. The lowest mean score was observed for physical activity, consistent with findings from other studies [33, 34].

Cho *et al.* [22] and Agapito *et al.* [23] report no relationship between eHEALS scores and physical activity. Physical activity, being a practical component of HPLB, is often influenced by cultural and social factors, situational constraints, and

individual characteristics. Universities are therefore recommended to enhance students' physical activity by establishing on-campus and dormitory sports and recreational centers and addressing barriers to exercise through short-term strategic planning. Notably, female students and those living with their parents reported higher HPLB scores compared to males and dormitory residents. This may be explained by the fact that students living away from their families are less likely to be reminded of healthy habits than those living with their parents. Can *et al.* report that students' place of residence influences all six HPLB dimensions [35].

Dormitory living may increase stress levels and require independent decision-making during critical situations; therefore, health promotion strategies should increasingly focus on these student groups. There was a significant positive relationship between eHEALS scores and HPLB, with eHEALS predicting all six HPLB dimensions. Students with higher eHealth literacy were more likely to adopt health-promoting behaviors in health responsibility, spiritual growth, physical activity, nutrition, interpersonal relationships, and stress management.

This finding aligns with national and international evidence suggesting that individuals with higher eHealth literacy levels are more proactive in seeking health information and hold more positive attitudes toward Internet-based health information [23, 36]. Developing strategies to enhance students' eHealth literacy could, therefore, protect them from lifestyle-related diseases and help sustain their health-promoting behaviors.

A key strength of this study was the absence of selection bias in recruiting participants. However, the study was conducted among students from only one medical sciences university in Iran, with no comparison to other universities; thus, the generalizability of the findings to all medical sciences universities in the country is limited. Future research should examine and compare the lifestyles of students in medical and non-medical disciplines.

Conclusion

Students have moderate mean lifestyle scores on both the Electronic Health Literacy Scale and health-promoting lifestyle behaviors, with a positive correlation between the Electronic Health Literacy Scale and all dimensions of health-promoting lifestyle behaviors.

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Ethical Permissions: This study was approved by the Ethics Committee of Qazvin University of Medical Sciences (Ethics code: IR.QUMS.REC.1402.157).

Conflicts of Interest: The authors declared no conflicts of interest.

Authors' Contribution: Asli Beigi M (First Author) Introduction Writer/Methodologist/Assistant Researcher (20%); Mohammadi Zeidi I (Second Author), Methodologist/Statistical Analyst (20%); Ziaeiha M (Third Author), Introduction Writer/Methodologist (20%); Hosseini F (Fourth Author), Methodologist/Discussion Writer/Main Researcher (30%); Mokri A (Fifth Author), Methodologist/Assistant Researcher (10%)

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