Electronic Health Literacy in Predicting Health-Promoting Lifestyle Behaviors (HPLB): A Cross-Sectional Study among College Students

Abstract

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

Methods In this cross-sectional study, 376 students were selected in 2023-2024 using proportionate stratified sampling. Participants completed questionnaires on demographic characteristics, eHEALS, and HPLP-II. Data were analyzed using SPSSv22 software, employing descriptive and analytical tests including independent t-tests, Pearson's correlation and multiple regression analysis, at a significance level of $p < 0.05$.

Findings Of the 376 participants, 79.78% were under 22 years of age. The mean and standard deviation of the total HPLB and eHealth literacy scores were (127.5 ± 18.8) and (25.04 ± 5.63), respectively. The highest score among the HPLB dimensions was observed in spiritual growth and self-actualization, while the lowest was in physical activity. A significant relationship was found between eHealth literacy and students' HPLB, indicating that students with higher levels of eHealth literacy were more likely to engage in healthy behaviors. Multiple regression analysis revealed that age, gender, economic status, place of residence, and eHealth 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 It is recommended that eHealth literacy concepts be integrated into university curricula to enhance students' skills in using information technology for adopting health-promoting behaviors.

Keywords Student; Health Promoting Behaviors; Health literacy; eHealth; lifestyle

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 own health by acquiring and using health information from various sources (1)

Among these sources, the Internet has emerged as one of the main providers of health-related information (۲), enabling users to acquire the knowledge needed to enhance personal health and prevent diseases (3). Various groups of users, including university students, school students, and patients, commonly use the Internet to search for information and to make health-related decisions (٤). The academic community also has broad access to scientific and medical websites as well as national and international databases, and it is dependent on the Internet for these activities. In this context, an individual's ability to find, evaluate, and use 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 in Iranian society, as a considerable number of physicians and patients continue to prefer traditional processes for disease diagnosis and drug prescription. This preference can be attributed to a lack of ability to use information technology for health maintenance, which requires skills such as reading, computer use, information seeking, understanding health information, and applying it (٦).

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 of 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 (۹). 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 they are also more capable of understanding the information they find, verifying its accuracy, and using it to promote health-related behaviors (۱۱) In the context of eHealth literacy,

studies on university students have shown that eHealth literacy is positively associated with a HPLB, including behaviors such as healthy eating, exercise, not smoking, and adequate sleep (۱۳ ,۱۲).

A 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 the 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 (۱۹ ,۱۸). 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 establish the basis for better health in later life by reducing the risk of adverse health outcomes or 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 did not have sufficient eHealth literacy, and that improving eHealth literacy among nursing students is necessary, requiring measures such as curricular changes and enhanced information technology resources in educational settings.

Similarly, a study by Cho et al.(22) examining the relationship between eHealth literacy and HPLB among hospital nurses in South Korea found that nurses with higher eHealth literacy exhibited 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 (۲۳). 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). Accordingly, the present study was conducted to investigate the role of eHealth literacy in the adoption of health-promoting lifestyle behaviors among students at Qazvin University of Medical Sciences.

Materials & Methods

Design and Participants

This research was a cross-sectional descriptive-analytical study conducted from October 2023 to June 2024, with the endorsement of the university's ethical committee (IR.QUMS.REC. 1402.157). The study population included all students enrolled at Qazvin University of Medical Sciences, located in the northwest of Iran. Participants were selected from all faculties (Health, Paramedical Sciences, Nursing and Midwifery, Medicine, and Dentistry) through proportionate stratified sampling, taking into account 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.

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

The inclusion criteria for participation in this study were (a) being enrolled as a student at the time of data collection and (b) having completed at least one academic semester in the relevant faculty. Exclusion criteria included unwillingness to participate in the study, temporary enrollment for a single semester as a visiting student, and incomplete questionnaire responses. 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 Collection

The data collection instrument was a questionnaire consisting of three main sections:
Section 1: Demographic characteristics of participants, including gender, age, accommodation, student job, father education, mother education, father job, mother job, medical university field, health self-report and economic status.
Section 2: The *Electronic Health Literacy Scale (eHEALS)*, originally developed by Norman and Skinner (9), consists 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. (2016) (24), who translated and psychometrically evaluated it. The instrument demonstrated satisfactory internal consistency (Cronbach's $\alpha = 0.88$, $P < 0.001$) and test–retest reliability ($r = 0.96$, $P < 0.001$).
S*ection 3: 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: 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). Also, in this study, the reliability of the questionnaire was evaluated based on internal consistency (Cronbach's alpha coefficient) in a sample of 30 people, and the total reliability coefficient for the eHEALS and HPLP-II subscales was 0.86 and 0.91, respectively.
Data Analysis
Data were analyzed using SPSS version 22. The Kolmogorov–Smirnov test was used to assess the normality of data distribution. Independent t-tests were applied to compare mean values between groups, Pearson's correlation coefficient was used to examine associations between variables, and multiple regression analysis was performed to predict HPLB. The significance level was set at $p < 0.05$.
Ethical Consideration
This study is approved under the ethical approval code of Qazvin University of Medical Sciences (Ethics code: IR.QUMS.REC.1402.157).

Findings

The findings showed that among the 376 students, 61.44% were female and 79.78% were under the age of 22 years. Additionally, 46.01% of participants reported their health status as good (Table 1).
Table 1: general characteristics of students participated in research (N= 376)

Variable		N (%)	eHEALS (Mean ±SD)	HPLB (Mean ±SD)	P-Value**	P-Value***
Gender	*Male*	145 (38.56)	24.08 ± 5.67	123.4 ± 18.76	0.009	0.001
	Female	231 (61.44)	25.64 ± 5.53	129.96 ± 18.41		
Age	*< 22*	300 (79.78)	24.82 ± 5.51	128.03 ± 19.43	0.137	0.288
	> 22	76 (20.22)	25.90 ± 6.05	125.46 ± 16.01		
Accommodation	*Dormitory*	235 (62.5)	24.23 ± 5.52	125.07 ± 18.36	0.000	0.001
	Non-dormitory	141 (37.5)	26.37 ± 5.58	131.48 ± 18.87		
Student Job	*Unemployment*	288 (76.60)	25.17 ± 5.64	127.93 ± 19.15	0.417	0.665
	Part-time	70 (18.62)	24.90 ± 6.02	126.65 ± 17.88		
	Full-time	18 (4.78)	23.39 ± 5.62	124.28 ± 17.01		
Father education	*< diploma*	36 (9.56)	23.69 ± 6.25	128.81 ± 17.53	0.111	0.359
	Diploma	120 (31.93)	24.57 ± 5.54	125.49 ± 19.05		
	University	220 (58.51)	25.51 ± 5.53	128.41 ± 18.85		
Mother education	*< diploma*	56 (14.89)	23.37 ± 6.40	123.27 ± 17.04	0.70	0.058
	Diploma	180 (47.88)	25.40 ± 5.29	126.66 ± 18.81		

	University	140 (37.23)	25.17 ±5.69	130.13 ± 19.11		
Father job	*Unemployment*	12 (3.19)	26.67 ± 6.03	130.75 ± 26.24	0.258	0.008
	Farmer	42 (11.17)	23.57 ± 5.76	121.83 ± 18.15		
	Governmental job	217 (57.71)	25.14 ±5.68	126.15 ±18.65		
	Private job	105 (27.93)	25.22 ± 5.39	132.13 ± 17.56		
Mother job	*Unemployment*	213(56.65)	24.44 ± 5.44	126.68 ± 20.40	0.90	0.576
	Farmer	7 (1.87)	27.71 ± 5.43	129.00 ± 19.19		
	Governmental job	129 (34.30)	25.65 ± 6.02	127.86 ± 17.28		
	Private job	27 (7.18)	26.11 ± 4.73	131.92 ± 2.56		
Medical university Field	*Health*	66 (17.55)	26.68 ± 5.96	134.03 ± 20.40	0.000	0.000
	Medical & dentistry	188 (50.0)	24.91 ± 4.70	130.45 ± 15.10		
	Paramedical	49 (13.03)	26.65 ±5.65	120.71 ± 18.86		
	Nursing & midwifery	73 (19.41)	22.78 ± 6.71	118.10 ± 21.45		
Health self-report	*Too week*	2 (0.53)	13.00 0.00	91.00 ± 0.00	0.000	0.000
	Week	15 (3.98)	22.00 ±7.70	121.93 ± 26.25		
	Moderate	117 (31.12)	23.26 ± 5.35	119.38 ± 16.74		
	Good	173 (46.01)	26.06 ± 5.30	128.68 ± 15.41		
	Very good	64 (17.02)	26.72 ± 4.95	141.64 ± 19.42		
Economic status	*Too week*	6 (1.59)	20.83 ±8.93	118.17 ± 29.62	0.000	0.000
	Week	46 (12.23)	22.19 ± 5.24	117.64 ± 19.46		
	Moderate	172 (45.74)	24.59 ± 5.49	124.68 ± 15.24		
	Good	133 (35.37)	26.08 ± 5.04	133.09 ± 18.42		
	Very well	19 (5.05)	29.95 ± 5.97	140.10 ± 26.62		

* Correlation is significant at 0.01 level, ** eHEALS: eHealth Literacy Scale; *** HPLB =Health-promoting lifestyle Behaviors

As shown in Table 1, there was a statistically significant relationship between eHEALS scores and the demographic variables of gender, place of residence, faculty, self-reported health status, and economic status (P <.05). Moreover, gender, place of residence, faculty, father's occupation, self-reported health status, and economic status were significantly associated with HPLB scores (P <.05). According to Table 2, the mean score of HPLB was 127.5, 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 The scores of totals and dimensions of HPLB and eHEALS literacy

Variables		**Mean (SD)**
HPLB dimensions	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 of HPLB	127.5 (18.8)
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

As presented in Table 3, based on Pearson correlation matrix coefficients, 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 ($r = 0.39$, $P < 0.01$), spiritual growth ($r = 0.39$, $P < 0.01$), physical activity ($r = 0.34$, $P < 0.01$), nutrition ($r = 0.40$, $P < 0.01$), interpersonal relationships ($r = 0.41$, $P < 0.01$), and stress management ($r = 0.38$, $P < 0.01$).

Table 3: Pearson correlation matrix (r coefficient) of HPLB dimensions and eHEALS

Variables		**Health-promoting lifestyle Behaviors**							**eHEALS**
		1	2	3	4	5	6	7	
HPLB dimensions	١. Nutrition	1							
	2. Physical activity	0.50**	1						
	3. Health responsibility	0.58**	0.60**	1					
	4. Stress management	0.53**	0.53**	0.48**	1				
	5. Interpersonal relationship	0.60**	0.32**	0.47**	0.64**	1			
	6. Spiritual growth	0.53**	0.39**	0.45**	0.73**	0.68**	1		
	7.Total HPLB	0.79**	0.70**	0.76**	0.82**	0.80**	0.81**	1	
eHEALS literacy		0.40**	0.34**	0.39**	0.38**	0.41**	0.39**	0.48**	1

**correlation is significant at 0.01 level, HPLB = Health-promoting lifestyle Behaviors

As shown in Table 4, multiple regression analysis demonstrated that age, gender, economic status, place of residence, and eHEALS together explained 32% of the variance in nutrition ($R^2 = 0.235$, $p = 0.00$), 26% in interpersonal relationships ($R^2 = 0.261$, $p = 0.00$), 20% in spiritual growth ($R^2 = 0.202$, $p = 0.00$), 18% in health responsibility ($R^2 = 0.183$, $p = 0.00$), 16% in stress management ($R^2 = 0.162$, $p = 0.00$), and 11% in physical activity ($R^2 = 0.115$, $p = 0.00$). Furthermore, eHEALS predicted all six HPLB dimensions, such that a one standard deviation increases 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 ٤: Multiple regression analysis of individual factors and eHEALS predicting HPLB

Nutrition				Physical activity				Health responsibility			
B	β	t	p	B	B	t	P	B	B	T	P

Age	-0.11	-0.07	-1.55	0.15	Age	-.05	-0.03	-0.63	0.53	Age	-0.13	-0.07	-1.54	0.12
Gender	0.95	0.12	2.5	0.01	Gender	0.12	0.002	0.04	0.97	Gender	0.104	0.03	02.61	0.79
Accommodation	1.08	0.14	2.9	0004	Accommodation	0.08	0.01	0.21	0.83	Accommodation	0.62	0.07	1.52	0.13
Economic status	0.81	0.17	3.4	0.001	Economic status	0.54	0.11	2.19	0.03	Economic status	0.53	0.11	2.12	0.04
eHEALS	0.22	0.32	6.5	0.00	eHEALS	0.21	0.30	5.83	0.00	eHEALS	0.28	0.39	7.11	0.00
	R= 0.484 R^2= 0.235 F= 16.592					R= 0.356 R^2= 0.115 F= 10.733					R= 0.427 R^2= 0.183 F=16.490			

Table ٤: continued

	Stress management					Interpersonal relationship					Spiritual growth			
	B	β	t	p		B	B	t	P		B	B	T	p
Age	-.04	-.02	-.54	.58	Age	-.23	-.12	-2.77	.006	Age	-.20	-.11	-2.32	.02
Gender	.67	.08	1.79	.07	Gender	1.85	.20	4.49	.00	Gender	.76	.08	1.79	.07
Accommodation	.38	.04	.99	.32	Accommodation	-.25	-.02	-.60	.54	Accommodation	.58	.06	1.34	.18
Economic status	.20	.04	.85	.39	Economic status	.96	.17	3.73	.00	Economic status	.71	.13	2.65	.00
eHEALS	.23	.35	6.92	0.00	eHEALS	.27	.34	7.22	0.00	eHEALS	.26	.34	6.89	0.00
	R= 0.402 R^2= 0.162 F= 14.29					R= 0.511 R^2= 0.261 F= 25.97					R= 0.499 R^2= 0.202 F=18.69			

Discussion

The mean eHEALS score of students was 25.04 ± 5.63, indicating that students had a moderate ability to use electronic technologies for searching and accessing essential health-related information. This level was relatively similar to findings from other studies in Iran. For instance, Dashti et al. reported a mean eHEALS score of 28.21 ± 6.95 (26), while Isazadeh et al. found a mean of 28.15 ± 5.90 (6). In Japan, Tsukahara et al. reported a mean score of 23.6/40 among university students (27). According to Kim and 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 for acquiring both basic and advanced health information. In this paper, the HPLB score was in the moderate range among students of Qazvin University of Medical Sciences, consistent with the findings of Rokhzadi et al. (28), Pour Ebrahimi et al. (29), and Peker & Bermek (30), all of which reported moderate lifestyle scores among the majority of medical students. This may be attributed to the relatively similar circumstances of students in terms of 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, emphasis on spiritual care by university authorities, and 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 belief in a higher power, with potential positive effects on both mental and physical health. Fartookzadeh et al. have emphasized the deep link between Iranian-Islamic lifestyle and the spiritual dimension of society (32). The lowest mean score was observed in physical activity. Similar to other studies (33, 34).

Cho et al. (22) and Agapito et al. (23) no relationship between eHEALS and physical activity was found. Physical activity, being a practical component of HPLB, is often influenced by cultural and social factors, situational constraints, and individual characteristics. Universities are recommended to enhance students' physical activity by establishing on-campus and dormitory sports and recreational centers and addressing the 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 compared to those living with their parents. Can et al. reported that students' place of residence influenced 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. The study further demonstrated a significant positive relationship between eHEALS 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 is in line 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.

Conclusions

The mean lifestyle score among students was moderate for both eHEALS and HPLB, indicating the need for more precise and targeted planning to improve health-promoting lifestyles in this population. A statistically significant positive correlation was observed between eHEALS and all HPLB dimensions. Therefore, it is recommended that eHEALS-related concepts be integrated into university curricula to improve students' competency in using information technology for adopting health-promoting behaviors.

Strengths and Limitations

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, 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.