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The Relationship between Health Literacy and Health-Promoting Behaviors in Patients with Type 2 Diabetes Mellitus: Evidence from a Military Hospital-Based Study in Iran

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Background and Objective: Diabetes Mellitus (DM) ranks as one of the most common non-contagious diseases and its importance has been widely acknowledged. Nevertheless, health literacy and lifestyle factors have a big impact on how well people control and manage this condition. The current relationship between health-promoting behaviors and health literacy among DM patients of the Military hospital is discussed in this article.

Materials and Methods: This cross-sectional investigation encompassed a sample of 281 type 2 DM patients attending the endocrinology clinic at Baqiyatallah Hospital. Data collection was achieved through the employment of a checklist comprising 12 demographic items, a 33-item Health Literacy Instrument for Adults (HELIA) questionnaire, and a 51-item Walker's Health-Promoting Lifestyle Profile (HPLP II) questionnaire. Data analysis was completed by implementing Pearson's correlation coefficient, independent t-tests, analysis of variance, and hierarchical linear regression, which was done by using SPSS ver. 22.

Results: The mean age of the participants was calculated to be 45.2 ± 17.2 years. The participents' charachteristics mostly consisted of being men (66.9%), married (63.7%), and having a diploma (45.9%). In this study, a moderate positive correlation was found between health literacy and health-promoting behaviors (r=0.405) (p=0.000). Furthermore, people ages 45 and above and those with a non-medical job had the highest scores on health-promoting behaviors, and non-smokers had a higher score on health literacy. Liner Regression analysis demonstrated that reading, access, decision-making, and behavioral intention significantly predicted health-promoting behaviors (R^2=0.295, p<0.000),with decision-making showing the strongest effect (β=0.242, p=0.002).

Conclusion: The findings of the current study verify that there is a relationship between health literacy and lifestyle, and that edjucational programs focus more on improving specific domains like accessing, reading and decision-making, as identified in the regression for DM patients.

Keywords: Diabetes Mellitus, Health Behavior, Health Literacy, Lifestyle, Self Care

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Introduction

The topic of health literacy has gained attention in developed nations when it comes to enhancing public health (1). Health literacy refers to a person's ability and capacity to comprehend, interpret, and obtain basic health-related information and services, which is essential for informed decision-making (2). Since health literacy is being used more and more to predict health-related outcomes, it is a significant public health concern (3). Low health literacy also increases the likelihood that people will take dangerous medications and have inadequate self-care abilities (4).

Lifestyle encompasses various aspects, such as proper diet, physical activity, healthy sleep, self-care, use of alcohol, tobacco, and illegal drugs, as well as social interactions and stress reduction (5). In a statement from the First World Conference on Healthy Lifestyles in Moscow, the World Health Organization (WHO) said that unhealthy lifestyles currently cause 60% of deaths worldwide and 80% of deaths in developing nations, with estimates indicating that by 2030, this percentage could rise to 75% of deaths worldwide (6). Lifestyle-related diseases are regarded as the leading cause of death and disability in Iran. Furthermore, research has demonstrated that lifestyle changes such as maintaining a healthy weight and diet, quitting smoking, and engaging in more physical activity can potentially prevent up to 90% of cases of type 2 Diabetes Mellitus (DM), 80% of cases of cardiovascular disease, and a third of cancer cases (7).

Type 2 DM is a major public health problem around the world, characterized by chronic elevation of blood glucose levels due to insulin resistance, impaired functionality of pancreatic beta cells, and impaired insulin secretion. The genetic factors that account for approximately 10 to 15% of type 2 DM cases are as follows. Moreover, the likelihood of

developing type 2 DM is significantly influenced by environmental factors including insufficient physical activity, obesity, unhealthy nutritional habits, and aging.

The WHO has reported that factors such as lack of physical activity, obesity, and being overweight are the cause of at least two-thirds of type 2 DM cases, and among the factors affecting people's health, such as genetics, healthcare access, environment, and lifestyle, 51% of cases are attributable to lifestyle. The relationship between lifestyle, environmental factors, and health literacy has been examined within the academic community. However, lifestyle and health literacy are of greater importance for patients, particularly in chronic DM. These results confirm that diabetic patients have a generally inferior lifestyle compared to their non-diabetic counterparts (8). Moreover, it appears that health literacy significantly affects lifestyle, including a range of selective behaviors. Several studies have shown that health literacy affects diabetes care management and outcomes (9).

While previous studies have explored the relationship between health literacy and health-promoting behaviors, research on relevant topic among DM in Iran remains limited (10-13). By examining particular aspects of health literacy, their influence on lifestyle choices, and the connection between type 2 DM patients' health literacy and lifestyle choices that promote health, this study seeks to close this gap. Furthermore, it would become clear that patients needed lifestyle education in line with health literacy principles if the relationship was found to be statistically significant.

Material and Methods

This cross-sectional (descriptive-analytical) investigation included a study comprising individuals diagnosed with type 2 DM (according to medical records and self-declaration at the diabetes clinic) who were attending the endocrinology clinic at Baqiyatallah hospital during the winter season of the year 2023-2024. The criteria for inclusion in this study required the participants to have intermediate reading and writing literacy (which was measured by directly asking the particpipents about their level of education), and have been diagnosed with type 2 DM according to their medical documents. Being unwilling to take part in the study, and having incomplete answers in the questionnaire were among the exclusion criteria.

According to the study conducted by Arabi and Soleimanpour, a correlation of approximately 0.2 between the dimensions of health-promoting lifestyle and health literacy among DM patients was identified (14). By considering this correlation, along with a statistical power of 90%, and a type I error rate of 5% in the sample size formula which was utilized for correlation calculations, a sample size equal to 259 patients was determined, which was subsequently adjusted to approximately 280 individuals to account for an estimated attrition rate of 10%.

$$N = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{(0.5ln\frac{1+\rho}{1-\rho})^2} + 3$$

In this manner, after obtaining the ethics certificate from the university and acquiring informed consent from the participants, the link to the questionnaires was distributed through SMS or online communication platforms (such as Eitaa, Soroush, Telegram, etc.) over a span of 74 days from November 2023 to February 2024, during the working hours of the endocrinology clinic (5 days a week). This link was distributed in person and made accessible to diabetic patients who were referred to the endocrinology clinic. Then, by using the self-reporting method, the participants filled out the questionnaires. Thus, this study's sampling method was convenience sampling.

In fact, once the study's objectives were explained to all participants, a questionnaire was sent to 300 patients in virtual format, of which 19 participants failed to complete the questionnaire. Ultimately, 281 patients successfully filled out the questionnaire.

Instruments

A questionnaire composed of three sections was utilized in this study.

The First Section: Personal Characteristics

This section consisted of personal characteristics including gender, age, occupation, education, marital status, weight, height, physical activity, annual health check-ups for specific conditions, along with smoking, taking prescription medication, and DM history.

The Second Section: Health-Promoting Lifestyle Profile II (HPLP II)

This instrument is a modified version of the Health-Promoting Lifestyle Profile (HPLP) which was developed by Walker et al. It evaluates health-promoting lifestyles, which is done by focusing on people's perceptions and responsibilities that contribute to the enhancement or maintenance of their personal satisfaction, overall well-being, and self-fulfillment.

In Iran, the aforementioned tool has been validated and deemed reliable by Mohammadi Zeidi et al., in which the total number of items was reduced from 52 to 49, the overall Cronbach's alpha coefficient for the entire tool being reported at 0.082, and for the sub-category coefficients (6 dimensions) ranging from ٠.64 to ٠.91 (15). This questionnaire provides four response options for each item, which are never, sometimes, often, and always, with a scoring system of 1 to 4, and it evaluates six dimensions including responsibility towards one's health, stress management, interpersonal relationships, physical activity, nutrition, spiritual growth and self-actualization. A score below the mean score (less than 130 points) was considered to be an undesirable lifestyle, whereas a score above the mean score (more than 130 points) was considered to be a desirable lifestyle (16).

The Third Section: Health Literacy Instrument for Adults (HELIA)

In the third section, health literacy was assessed by using the HELIA questionnaire (which is the Health Literacy Questionnaire for Adults of the Iranian Urban Population). This questionnaire consists of 33 items with five response options across various dimensions including access (6 items), reading (4 items), evaluation (4 items), comprehension and understanding (11 items), and decision-making and behavioral intention (8 items). This tool has been validated in Iran by Montazeri et al. The Cronbach alpha coefficients for the questionnaire's items were between 0.72 and 0.89, which confirms its reliability (17). The range of scores obtained is from 33 to 165. The range of scores according to the 1 to 5 scoring system is from 0 to 50, which is considered insufficient, 50.1 to 66 are limited, 66.1 to 84 are "sufficient", and 84.1 to 100 are "excellent".The cut-off point for being statistically sufficient starts at 66.1. Therefore, we standardized the classification reference accordingly(18). Thus, the raw scores were converted to a scale of 0 to 100. Therefore, scores of 33 to 99 are "insufficient", 100 to 120 are "limited", 121 to 144 are "sufficient", and 145 to 165 are "excellent".

Analysis

Data analysis was was performed via the use of SPSS ver. 22. The Kolmogorov-Smirnov (KS) test was utilised to evaluate data normality. Given the fact that the normality assumption was achived, parametric tests were used (including Pearson's correlation) to assess relationships, independent t-tests and ANOVA for group comparisons, and Hierarchical linear regression to ascertain predictors of health-promoting behaviors. Regression assumptions (linearity,

multicollinearity, homoscedasticity, and normality of residuals) were checked before model interpretation, with model fit evaluated using R^2 and adjusted R^2. In the end, the threshold for statistical significance was $p<0.05$.

Results

The mean age of the participants was calculated to be 45.2 ± 17.2 years. Most of the study population comprised patients with the characteristics of being male (66.9%), married (63.7%), and having a diploma (45.9%). Furthermore, 22.4% of the participants were smokers, and a history of comorbid conditions apart from DM was noted in 24.2% (68 cases) of the participants. On average, the duration of the DM disease among the participants was 4 years, and 68.7% of the participants had a history of taking prescription medication, where metformin emerged as the most commonly used medication (30.2%).The health-promoting behaviors' mean score was 137.6 ± 21.4, while the health literacy's mean score was 121.3 ± 20.2, thereby indicating that health-promoting behaviors was at a sufficient level whereas health literacy was at a desirable level.

According to **Table 1**, the demographic variables of occupation (P=0.000), and age (P=0.002 had a relationship with health-promoting behaviors. Meaning that, individuals over 45 years of age have a higher score in terms of health-promoting behaviors. Those with non-medical jobs, particularly veterans, attained the highest score in health-promoting behaviors. Smokers also had a higher score in terms of health-promoting behaviors, but this difference is at the threshold level of significance (P=0.057). In addition, only the variable of smoking was related to health literacy (P=0.007). Non-smokers presented a higher score in health literacy, and this difference is statistically significant. There were no significant differences across the other variables.

A positive correlation was identified between health-promoting behaviors and *Health Literacy* (r=0.405), and the relationship between these two factors was statistically significant (p=0.000).

This finding indicates that with the increase of people's health literacy, their health-promoting activities will increase as well. Domain-specific correlations further show cased that the decision-making and behavioral intention domain of *Health Literacy* manifested the strongest relationship with the overall health-promoting behaviors (r=0.402, p<0.001), followed by

evaluation (r=0.332, p<0.001), reading (r=0.319, p<0.001), access (r=0.309, p<0.001), and comprehension and understanding (r=0.279, p<0.001).

Analyses of individual health-promoting behaviors subscales demonstrated that: Interpersonal relationships exhibited the strongest correlation with the decision-making domain of Health Literacy (r=0.397, p<0.001). Responsibility toward one's health demonstrated its highest association with evaluation (r=0.349, p<0.001). Stress management correlated most with decision-making (r=0.390, p<0.001). Both nutrition and physical activity had the strongest correlation with decision-making (r=0.273 and r=0.253, respectively; p<0.001 for both). Spiritual growth and self-actualization both had significant relationships with access (r=0.318, p<0.001) **(Table 2).**

In order to study the influence of health literacy and its dimensions on health-promoting behaviors in DM patients, a two-stage hierarchical regression analysis was conducted.

In the first model, only demographic variables were incorporated. This model was statistically significant (F (7,266)=4.362, p<0.001) and accounted for 10.3% of the variance in health-promoting behaviors (R^2=0.103). In this model, age (β=0.277, p=0.001) and occupation (medical vs. non-medical; β=−0.201, p=0.006) were identified as significant predictors, indicating that with advancing age, the level of healthier lifestyle also increased. Additionally, DM patients employed in medical occupations had lower lifestyle scores than those in other occupations.

In the subsequent model, the dimensions of health literacy were also included as independent variables (including: reading, access, comprehension, evaluation, decision-making, and behavioral intention). This model was also significant (F (12,261) =9.786, p<.001) and was able to increase the amount of explained variation to 29.5% (R^2=0.295, Adjusted R^2=0.263). In addition to age and occupation, marital status also appeared as a significant predictor of health literacy:

- Age (β=0.344, p<0.001): This indicates that the tendency towards a health-promoting lifestyle increases with age.

- Marital status (β=−0.175, p=0.007): Married diabetic patients had lower healthy lifestyle scores compared to their single counterparts.
- Occupation (β=−0.170, p=0.010): Diabetic patients working in healthcare had lower healthy lifestyle scores compared to those with non-medical jobs.

Among the dimensions of health literacy, three dimensions had a statistically significant effect on lifestyle: Decision-making and behavioral intention (β=0.242, p=0.002): It is the strongest positive predictor, indicating the key role of decision-making skills in choosing healthy behaviors.Access to health information (β=0.197, p=0.020): Increased access is associated with improved lifestyle.Health information reading skills (β=0.147, p=0.047): The ability to read health materials has a positive effect on healthy behaviors. In contrast, the dimensions of understanding (p=0.663) and evaluation (p=0.857) had no significant relationship with health-promoting behaviors **(Table 3 ,4).**

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Table 1. Comparison of Demographic and Clinical Factors Associated with *Health Literacy* Instrument for Adults (HELIA) and Health-Promoting Lifestyle Profile (HPLP II) (N=281)

Variables	Variable description	HELIA			HPLP II		
		Mean	SD	P-value	Mean	SD	P-value
Age	45 years and below	123.09	22.035	0.175	133.56	21.881	0.002**
	Older than 45 years	119.63	18.41		141.31	20.492	
Gender	Female	121.77	20.445	0.763	138.41	23.098	0.685
	Male	121.00	20.175		137.30	20.672	
Marriage status	Single	119.79	21.288	0.361	135.40	23.130	0.182
	Married	122.09	19.616		138.96	20.418	
Occupation	Non-medical	116.81	19.879	0.668	139.43	22.853	0.001***
	Medical	120.22	23.911		127.81	20.654	
	Armed forces	114.57	18.343		142.83	18.603	
	Veteran	115.90	9.585		155.90	18.436	
	Other	125.12	18.770		139.24	21.056	
Education	Middle school diploma	114.19	13.864	0.64	139.19	20.858	0.229
	High school diploma	123.44	18.812		137.30	21.410	
	Associate and bachelor's degree	123.96	21.679		144.38	23.233	
	Master's degree	113.35	20.589		134.32	19.769	
	Doctorate	123.87	25.966		129.26	18.177	
Smoking	No	122.80	21.035	0.07**	136.36	21.927	0.057*
	Yes	115.92	16.204		142.21	19.289	
Taking prescription medication	No	124.32	21.543	0.264	136.37	22.547	0.238
	Insulin	112.50	21.904		132.00	18.149	
	Metformin	118.19	17.711		143.41	18.158	
	Gliclazide	125.33	20.137		140.33	28.930	
	Zipmet	131.50	21.361		129.50	11.845	
	Other	124.89	18.640		134.83	24.062	

P<0.05* P<0.01. ** P<0.001***

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Table 2. Correlation Between Health Literacy Instrument for Adults Domains (HELIA) and Health-Promoting Lifestyle Profile Components (HPLP II) (N=281)

Variables	Reading	Access	Comprehension and understanding	Evaluation	Decision-making and behavioral intention
Health-promoting behaviors	0.319***	0.359***	0.279***	0.332***	0.402***
Nutrition	0.17**	0.19**	0.16*	0.112	0.273***
Physical activity	0.171**	0.147*	0.102	0.192**	0.253***
Responsibility towards one's health	0.286***	0.291***	0.266***	0.349***	0.298***
Stress management	0.238***	0.201**	0.191**	0.349***	0.39***
Interpersonal relationships	0.348***	0.341***	0.324***	0.354***	0.397***
Spiritual growth and self-actualization	0.265***	0.318***	0.302***	0.241***	0.308***

P<0.05* P<0.01. ** P<0.001***

Table 3. Hierarchical Multiple Regression Analysis Predicting Health-Promoting Lifestyle Profile (HPLP II) Based on Demographic, Clinical, and Health Literacy Instrument for Adults (HELIA) Dimensions (N=281)

Independent variable		Unstandardized Coefficients		Standardized Coefficients	t	P.
		B	SE	Beta		
Model 1	(Constant)	137.125	9.620		14.254	0.000
	Gender (male vs female)	3.917	2.844	0.088	1.377	0.170
	age	0.342	0.104	0.277	3.280	0.001
	Marital status (Married vs. single)	-4.953	3.120	-0.113	-1.587	0.114
	Occupation(Therapeutic vs non-therapeutic occupations)	-9.909	3.578	-0.201	-2.769	0.006
	Education level (Bachelor's degree and above vs diploma and below)	1.089	2.549	0.025	0.427	0.670
	BMI (normal vs un normal)	-0.293	2.742	-0.007	-0.107	0.915
	Taking prescription medication (yes vs no)	-4.454	3.121	-0.098	-1.427	0.155
Model 2	(Constant)	76.677	11.596		6.612	0.000
	Gender	3.558	2.578	0.079	1.380	0.169
	Age	0.425	0.097	0.344	4.396	0.000

	Marriage	-7.669	2.822	-0.175	-2.718	0.007
	Occupation	-8.367	3.223	-0.170	-2.596	0.010
	Education level	1.290	2.310	0.030	0.559	0.577
	BMI	-2.133	2.504	-0.047	-0.852	0.395
	Taking prescription medication	-3.784	2.806	-0.083	-1.349	0.179
	Reading	1.033	0.519	0.147	1.991	0.047
	access	0.982	0.420	0.197	2.335	0.020
	Comprehension and understanding	-0.122	0.279	-0.042	-0.436	0.663
	Evaluation	0.100	0.551	0.016	0.181	0.857
	Decision-making and behavioral intention	0.898	0.290	0.242	3.096	0.002

a) Dependent Variable: HPLP II
b) Std. Error SE

Table 4. Model Summary and R^2 Change for Hierarchical Multiple Regression Predicting Health-Promoting Lifestyle Profile (HPLP II)

Model	R	R Square	Adjusted R Square	SE	R Square Change	F Change	Sig. F Change
1	0.321[a]	0.103	0.079	20.262	0.103	4.362	0.000
2	0.543[b]	0.295	0.263	18.135	0.192	14.214	0.000

Discussion

This study's objective was to examine the relationship between health-promoting behaviors and health literacy among type 2 DM patients. The mean age of the participants was calculated to be 45 years, and most of the said participants were married military men with a diploma-level education.

The health-promoting behaviors variable was assessed to be at a favorable level, surpassing the findings of Bahramian's study involving diabetic patients (19) , Maheri et al.'s study (20) and Wang's study in china, all of which were reported to be at an average level. Notably, Health Promotion Scale for People with Diabetes Mellitus (T2DHPS) was used in the studies of Maheri et al. and Wang. This difference is explainable due to the more recent nature of our study, the type of specialized tools used in the two mentioned studies, and the more strict grading of the mentioned tools. It is reasonable to conclude that diabetic patients tend to maintain a more disciplined lifestyle.

The results of the present study showed that the mean health literacy score in the DM patients was at a favorable level. This finding indicates the relative awareness and ability of the participants in understanding, processing, and applying health-related information. However, a review of similar studies in other countries and even within Iran indicates the existence of significant differences in the level of health literacy in different societies. For example, a Chinese study showcased that 310 patients exhibited a low level of health literacy (21), and 360 patients in Malaysia indicated that 85.8% of them had limited health literacy (22). Similarly, a study involving 138 diabetic patients in Iran reported that 52.9% exhibited inadequate health literacy, with the mean health literacy score being 45.23 out of 100 (23). Furthermore, in Tol A's study, the level of health literacy was similarly found to be at an average level within the hospitals affiliated with the Tehran University of Medical Sciences (located in Iran) (24).

Based on the obtained results, it seems that several factors including cultural conditions, level of education, health policies, and access to information resources, appear to have an impact on health literacy. In the present study, older DM patients and non-medical personnel, especially veterans, had the highest score of health-promoting behaviors, which is in agreement with the findings of Ansari and Zareipour (25, 26). The variables of age and occupation were associated with health-promoting behaviors, which is most likely due to the

participants having gone through specialized training, better quality of health services in the military and their health insurance, and the fact that with the increase in age, people pay more attention to their health.

However, the health literacy variable did not have a statistically significant relationship with age.

Nonetheless, as diabetic patients' age increases, their health literacy decreases. This decline can be attributed to the fact that as people age, reading seems to become more difficult for them. Moreover, older adults are often susceptible to cognitive diseases, rendering the completion of research questionnaires more challenging due to potential difficulties in understanding the questions' meanings.

Furthermore, although the difference was marginally significant, smokers scored higher on these health-promoting behaviors, which may be related to their compensatory behaviors. On the other hand, non-smokers had significantly higher health literacy. This implies that higher health literacy increases the likelihood of adopting healthier habits and abstaining from dangerous ones like smoking. However, an editorial study noted that no association was found between health literacy and alcohol or tobacco consumption (27). This can be attributed to the complexity of risky behaviors and multiple confounding factors.

The results of the current study demonstrate that diabetic patients who have better decision-making ability pay more attention to their health and have healthier behaviors in personal and social contexts. In addition, responsibility is closely related to the skill of evaluating information, meanning that, diabetic patients who can assess the accuracy of information feel more responsible for their health. The relationship between health literacy dimensions and health-promoting behaviors is affected by cultural, social, and individual conditions. Decision-making and evaluation skills are two key dimensions in promoting the personal health of diabetic patients, and focusing educational programs on these two skills can be more effective.

In the study, there was no significant relationship between "understanding health information" and "actively engaging in physical activity". Furthermore, the lack of understanding of health information was linked to a higher chance of unhealthy food habits and lack of physical activity (28). Generally, individuals with elevated health literacy levels

tend to engage in reduced smoking behavior and demonstrate greater adherence to treatment regimens.

In the present study, a moderate positive relationship was identified between health-promoting behaviors and the dimensions of health literacy. A study from South Korea demonstrated a significant relationship between electronic health literacy and health-promoting behaviors (r=0.15) (29).

The findings of another South Korean study furthermore showcased that individuals with higher health literacy levels have more capabilities and those with superior capabilities have a greater desire towards healthy dietary practices and physical exercise (30). In a similar study in Iran, on a sample of 300 health-literate diabetic patients, demonstrated that there is a significant relationship between self-efficacy related to diabetes and self-care activities alongside health-related quality of life (31). In a separate study in Iran, a statistically significant relationship was established between health literacy and all dimensions of health-promoting behaviors, which is similar to our study (P = 0.000, r = 0.444) (32). The dissimilarity of the studied populations may be the cause for this difference. In addition, studies conducted on the military population have their own complications and may influence the results.

Therefore, interventions aimed at enhancing these specific dimensions of health literacy are able to have a more positive effect on diabetic patients' health behaviors.

The findings showed that older diabetic patients, who had higher decision-making, information access skills, and the ability to read health information, had healthier lifestyles. Moreover, married diabetic patients and those who work in healthcare had lower scores in health-promoting behaviors and lifestyle than patients who are single and have non-medical occupations. Health literacy dimensions, when added to demographic factors, increased the explained variation of health-promoting behaviors to 29.5%. E-health literacy was found to be the only significant predictor of the patients' self-care activities after adjusting for treatment type, home blood glucose monitoring, marital status, occupation, and economic circumstances (33). This variable explained 27.7 percent of the variance in self-care activities (B=0.277, T=4.5, P<0.05). Which was lower than the current study. This is in contrast to another similar study that found that health literacy alone could explain the 47.5% of changes in Health-Related Quality of Life (HRQL) (p<0.001), and among them, the dimension

of "health information study" played the strongest role (β=0.478) (34). Another study done on diabetic women indicated the two variables that combined could significantly predict about 51% of lifestyle changes, were health literacy and demographic (35). In one study, 49.7% of the variation in Health Promoting Behaviors (HPBs) was explained by demographic and health literacy factors combined (36).

Compared to the present study, three earlier studies were able to explain more variance. The differences in values may depend on the sample characteristics, measurement instruments, and the number of health literacy dimensions. In conclusion, health literacy, in addition to demographic variables, plays an important role in predicting health behaviors in diabetic patients. Decision-making and behavioral intention are the strongest positive predictors of health-promoting behaviors, indicating the key role of decision-making skills in choosing healthy behaviors in diabetic patients. In a similar study, the two dimensions of access and decision-making played a role in the prediction of health-promoting behaviors (37). In line with the present study, in another study on an urban adult population, decision-making emerged as the most influential component of health literacy in predicting HPBs (β=0.606) (36). One noteworthy limitation of the current study is its cross-sectional design method, a high number of questions, and its focus on military personnel who are diabetic patients. On the other hand, the lack of studies in the military field is considered to be an advantage of this study.

Conclusion

The findings of this study showed that, alongside access to health information and writing proficiency, health-promoting behaviors among diabetic patients are strongest predictors of health-promoting behaviors. This finding highlights the need for DM patients to obtain not only the ability to access and read health information, but also to analyze, evaluate and make informed decisions related to the management of their disease in order to effectively engage in self-care behaviors. Therefore, educational programs focusing on improving these skills should be developed for DM patients. Specifically, problem-solving training, analysis of real clinical situations, practice with decision-making scenarios, and group workshops should be part of the training aimed at improving decision-making skills. In addition, simplified content, visual brochures, and interactive digital tools such as health education applications (with simple language and quick information search

capabilities) should be used as educational programs in order to improve individuals' reading skills and access to information.

Furthermore, it is recommended that structured collaborations with specific institutions and organizations be established to make these interventions more effective. These collaborations can be carried out through the provision of face-to-face and online counseling services, the development of multimedia educational content, and the organization of continuous education courses for patients. Finally, in order to increase the explanatory power of behavioral models and improve the coefficient of determination (R^2), it is suggested that in future researches, in addition to health literacy and demographic variables, psychosocial factors such as social support, self-efficacy, and health-related attitudes should also be included into the modeling framework to obtain a more comprehensive and accurate understanding of the factors influencing the lifestyle choices of diabetic patients. Additionally, we recommend that, relevant topics such as blood sugar level indicators (e.g., hemoglobin A_1c), therapeutic literacy, and drug literacy, be further explored in future researches, particularly in longitudinal studies.

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Consent for publication: Not applicable

Ethical approval and consent to participate: The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Consent forms were filled out prior to participation in the study, and the treatment of those who did not participate was not altered. The researcher also explained this study's steps and process to all of the participants and that their anonymity and data confidentiality will be maintained throughout the study. Additionally, approval from the university's ethics committee, designated under the code of ethics IR BMSU.REC.1402.020, was obtained.

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Authors' contribution: F. Rahmati and L. Khedmat construct and supervised this study. A. Faeghi implemented the project and collected the data. M. Raei provided statistical consultation and analysis. E. Naimi served as the clinical advisor. F. Rahmati and L. Khedmat

drafted and revised the manuscript. All authors reviewed and approved the final version of the manuscript.

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