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Association between General Health Literacy (HELIA) and Self-Care Ability (SASE) among Older Adults with Type 2 Diabetes in Ahvaz, Iran: A Cross-Sectional Study

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Abstract

Background and Objective: Type 2 diabetes mellitus (T2DM) is a common chronic disease among older adults, and its management depends largely on self-care ability. While health literacy is an important factor influencing self-care, evidence on its association with self-care in older adults with diabetes is inconsistent. This study aimed to examine the relationship between health literacy and self-care ability in older adults with T2DM in Ahvaz, Iran.

Methods: This descriptive cross-sectional study was conducted in 2023 on 193 adults aged ≥60 years with T2DM in Ahvaz, Iran, selected through convenience sampling. Data were collected using the Abbreviated Mental Test, a demographic questionnaire, the 33-item Health Literacy for Iranian Adults (HELIA) questionnaire, a general (non-diabetes-specific) health literacy instrument, and the 17-item Self-Care Ability Scale for the Elderly (SASE). Data were analyzed using non-parametric tests in SPSS version 20.

Findings: The mean health literacy and self-care ability scores were 80.95±13.74 and 69.91±7.32, respectively. Approximately 50.3% of the participants demonstrated excellent health literacy. Among its dimensions, comprehension achieved the highest score, whereas reading recorded the lowest. Furthermore, age, education, and occupation were significantly associated with both health literacy and self-care capacity ($p<0.05$), whereas sex showed no such association. A significant positive correlation was found between health literacy and self-care ability ($r=0.430$, $p<0.001$).

Conclusion: The findings revealed relatively favorable health literacy alongside moderate self-care ability. The significant positive correlation between the two indicates that enhancing health literacy may serve as a promising strategy to promote self-care in older diabetic patients. Simple, accessible, and verbally based educational programs are recommended, especially for less educated and vulnerable older adults.

Keywords: Health literacy, Self-care, Older adults, Type 2 diabetes, Ahvaz.

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1. Introduction

Aging is a physiological process that is not inherently pathological; however, the interplay of advancing age, environmental factors and an unhealthy lifestyle increases the prevalence of chronic diseases, including type 2 diabetes (T2DM). Therefore, this condition imposes a heavy burden on the elderly individual, the family, and the country's health system (1). Diabetes is one of the most important non-communicable chronic diseases worldwide, and according to the World Health Organization, it is associated with complications such as cardiovascular disease, renal failure, blindness, and amputation, effective control of which requires the patient's active participation (2). According to the report of the International Diabetes Federation, the prevalence of this disease is increasing, and the elderly constitute a significant proportion of those affected (3). In Iran, the national STEPS survey in 2021 estimated the prevalence of diabetes among adults at 14.2%(4). A recent meta-analysis found that Khuzestan had the highest prevalence of T2DM among Iranian provinces (15.3%) (5), and a provincial survey of older adults in Khuzestan reported a diabetes prevalence of 28.6% (6).

Due to comorbidities, decline in cognitive and physical function, and the complexity of treatment, the elderly are more susceptible than others to the adverse consequences of diabetes. Self-care is one of the fundamental pillars of diabetes control, and according to the recommendations of the American Diabetes Association, it includes blood glucose monitoring, regular medication use, dietary adherence, physical activity, foot care, and regular clinical visits (7). Without the sustained implementation of these behaviors, adequate glycemic control and prevention of chronic complications will be difficult. Therefore, self-care is not merely an educational recommendation but a practical determinant of disease outcomes. In recent years, health literacy has been proposed as one of the key factors in the success of self-care. Sorensen et al., for instance, defined it as the ability to access, understand, appraise, and apply health information for informed decision-making, which extends beyond simply reading medical information to include critical comprehension and its effective application in daily life (8). Health literacy is increasingly viewed as a midstream determinant of health, with a social gradient observed in national surveys (9), and limited health literacy remains common even in high-income settings (8). In diabetic patients, this skill is vital for understanding treatment instructions, recognizing warning signs, and implementing care behaviors. A systematic review by Berkman et al. showed that low health literacy is associated with poorer health outcomes, less use of preventive services, and weaker comprehension of treatment recommendations (10). Schillinger et al., in the field of diabetes, reported that patients with low health literacy had poorer glycemic control and were more prone to medication inconsistency and weaker treatment adherence (11). These findings identify health literacy as one of the important determinants of self-care success. In most societies, the elderly face the highest risk of decline in physical, psychological, and cognitive abilities, and depend more than others on formal or informal support to maintain health and self-sufficiency (12). Unlike other chronic diseases, successful diabetes management is heavily dependent on daily self-care behaviors (13), and self-care ability is considered one of the core concepts in the management of chronic diseases, particularly diabetes, in the elderly (14). Attention to self-care and self-responsibility among the elderly is a supportive strategy that requires a high level of health literacy (12). The World Health Organization has identified health literacy as one of the greatest determinants of health and has recommended that countries promote it (12, 15). Health literacy encompasses the capacity to obtain, interpret, and understand health information for appropriate decision-making, and includes the skills of reading, listening, analyzing, and applying this information, without necessarily depending on educational level (15, 16). Low health literacy is associated with poorer health status, greater inequality, and higher health-system costs, and is more prevalent among the elderly who face greater risk due to difficulty in understanding health information (17, 18). Self-care is a multidimensional construct influenced by health beliefs, motivations and economic conditions (19), and encompasses managing a healthy lifestyle, treating minor ailments, managing chronic diseases, and post-discharge care. This process enables individuals to exert greater control over their own health (20). Self-care ability is influenced by numerous factors, including age, sex, health status, life experiences, sociocultural factors, factors related to the healthcare system, and available resources, alongside additional conditioning factors proposed by Orem. Sheikh Sharafi et al. demonstrated a direct and positive association between age, education, and occupation and self-care (21).

Approximately 58% of individuals over 65 years of age require assistance with daily activities, and self-care ability declines with increasing age, a decline also confirmed by Hauman et al. in the elderly (22). Self-care in diabetes includes adherence to diet, regular physical activity, blood glucose monitoring, foot care, and adherence to pharmacological treatment (23), and studies have shown that low health literacy is associated with poorer self-rated health and increased mortality among the elderly (17). Bagheri Nesami et al. demonstrated that age, education, and adequacy of economic status are demographic variables affecting self-care in the elderly (24). The study by Kyung Suk Shin also showed that elderly individuals with higher health literacy had greater empowerment, and more empowered individuals were more inclined toward

healthy nutrition and exercise (25). However, there are conflicting findings regarding the association between health literacy and self-care; for instance, Tamizkar et al. reported that, despite a moderate-to-high level of health literacy, self-care ability was inadequate in many elderly participants (17). In contrast, other studies have identified health literacy as an important factor in self-care behaviors, treatment adherence, and the use of preventive care among the elderly (12). With the growth of the elderly population, the prevalence of chronic diseases, including diabetes, is increasing, and the healthcare needs of this age group are becoming increasingly important (26). Through the implementation of the diabetes prevention and control program, the country seeks to reduce the complications, costs, disabilities, and premature mortality caused by this disease and to improve patients' quality of life. Diabetes requires long-term medical care, self-management education, and continuous support, and its control extends beyond mere glycemic management; studies have shown that patients' insufficient knowledge reduces their self-care ability and affects the occurrence of complications (1). Low health literacy is also associated with more frequent and prolonged hospitalization, lower quality of care, misunderstanding of health information, delayed treatment-seeking, inappropriate medication use, and non-adherence to medical recommendations. In the elderly, inadequate health literacy is associated with a higher prevalence of chronic diseases, more medical visits, and a greater need for emergency services (12). Evidence on the relationship between health literacy and self-care in older adults with diabetes comes largely from meta-analyses of general diabetic populations (27, 28) and from studies in other countries, such as Korea and Egypt (25, 29). In Iran, studies of older adults have examined health literacy and self-care ability in the general elderly population (17), among elderly women (18), or health literacy in relation to other outcomes such as self-efficacy among older adults with diabetes (30), and findings are inconsistent: some report a positive association (12, 25, 29), whereas others found inadequate self-care despite moderate-to-high health literacy (17). In southwest Iran, studies of older adults with type 2 diabetes have focused on self-care interventions and glycemic control (31), without examining health literacy. To our knowledge, the association between general health literacy (HELIA) and self-care ability (SASE) has not been examined in older men and women with type 2 diabetes in Ahvaz. Therefore, the present study was conducted with the aim of investigating the association between health literacy and self-care ability in elderly patients with diabetes. The study hypotheses were: 1) there is a significant association between health literacy and self-care ability in elderly diabetic patients; 2) demographic variables (age, sex, education, occupation) are associated with health literacy and self-care ability. to determine the level of general health literacy and self-care ability, and to examine their association, among older adults with type 2 diabetes in Ahvaz, in order to inform tailored educational programs for this group.

1. Methods

1.1. Study design

The present study is a descriptive cross-sectional study conducted with the aim of investigating the association between health literacy status and self-care ability in elderly patients with diabetes in Ahvaz City. The inclusion criteria were age over 60 years, a history of type 2 diabetes for at least one year, and willingness and consent to participate in the study; the exclusion criteria included lack of consent to participate, inability to communicate and respond to questions, and having a cognitive impairment as determined by the Abbreviated Mental Test [1](AMTS). In this study, health literacy was considered as the independent variable, self-care ability as the outcome variable, and age, sex, education, occupation, and living arrangement as background/confounding variables. This study was conducted in Ahvaz City (from 28 August to 21 November 2023), at Specialized Medical Services Center of the Academic Center for Education, Culture and Research (ACECR), Khuzestan Branch. The study population consisted of elderly individuals over 60 years of age with diabetes in Ahvaz City. Given that one of the study's objectives was to determine the health literacy status of the elderly in Ahvaz City — based on the study by Tamizkar et al., considering P = 86.7% (17), a 95% confidence interval, and an error of 0.05, and using the formula for calculating proportions, an initial sample size of 174 individuals was estimated, and, after accounting for a 10% attrition rate, a final sample size of 193 individuals was determined. In this study, community-dwelling elderly individuals with diabetes who had sufficient cognitive ability to respond to the questions were enrolled as a convenience sample. A convenience sampling method was used for participant recruitment.

1.2. Data collection

To fulfill the objectives of the study, the AMTS tool was used to assess the elderly participants for cognitive impairment and to determine study eligibility, followed by a researcher-made demographic questionnaire, and then a standard multi-part questionnaire covering health literacy and self-care ability in the elderly. The Abbreviated Mental Test (AMTS) was used to confirm the absence of cognitive impairment among the elderly participants in the study; this abbreviated cognitive test was validated in a 2014 (1393) study conducted in Tehran titled "Validation of the Persian Version of the Abbreviated Mental Test (AMTS) in Elderly Residents of Kahrizak Charity Nursing Home" by Bakhtiari

1. Abbreviated Mental test

et al. The Cronbach's alpha coefficient was 0.76. This study showed that the Persian abbreviated cognitive test has good validity and reliability in Iranian elderly individuals (32), and the demographic checklist included: age, sex, education level, and living arrangement. To measure health literacy, the validated and reliable questionnaire developed by Montazeri et al. (2014/1393), consisting of 33 items with 5 response options each, was used. This questionnaire comprises 5 domains: reading skills (4 items), access (6 items), comprehension (7 items), appraisal (4 items), and decision-making and application of health information (12 items). The Cronbach's alpha coefficients were 0.722 for reading skills, 0.791 for access, 0.869 for comprehension, 0.777 for appraisal, and 0.890 for decision-making. The scoring scale for the reading-skills and access items was as follows: "very difficult" scored 0, "difficult" scored 1, "neither easy nor difficult" scored 2, "easy" scored 3, and "very easy" scored 4. For the comprehension, appraisal, and decision-making items, "never" scored 0, "rarely" scored 1, "sometimes" scored 2, "often" scored 3, and "always" scored 4 (33).

The Self-Care Ability Scale for the Elderly (SASE) consists of 17 items and is used to assess self-care ability in elderly individuals. Each item is scored on a Likert scale ranging from 1 to 5, with response options of "strongly agree," "agree," "no opinion," "disagree," and "strongly disagree"; four items are negatively worded (items 6, 14, 16, and 17). The highest possible score is 85 and the lowest is 17. A score below 69 indicates low self-care ability, while a score of 69 or higher indicates high self-care ability. The calculated Cronbach's alpha coefficient indicated high internal consistency of the questionnaire (0.73) (34).

1.3. Statistical analysis

Data were analyzed using SPSS. Categorical variables were summarized as frequencies and percentages, and continuous variables were described using appropriate summary statistics. Normality was assessed using the Kolmogorov–Smirnov test, Q–Q plots, and skewness and kurtosis relative to their standard errors. The HELIA score was considered suitable for parametric analyses, whereas the SASE score did not follow a normal distribution.

The choice of statistical tests for group comparisons was based on the distribution of the outcome within each group and the relevant test assumptions. Independent-samples t-tests were used to compare mean scores between two groups when the assumptions of parametric testing were satisfied, and one-way analysis of variance (ANOVA) was used for comparisons involving more than two groups. When the overall ANOVA was statistically significant, pairwise comparisons were performed using Tukey's post hoc test. When the assumptions of parametric testing were not met, the Mann–Whitney U test was used for two-group comparisons and the Kruskal–Wallis test for comparisons involving more than two groups. Following a statistically significant Kruskal–Wallis test, pairwise comparisons were conducted using Dunn's post hoc test.

Spearman's rank correlation coefficients were used to examine associations between the HELIA total score and its domains and the SASE total score.

A multivariable linear regression model was fitted with the SASE total score as the dependent variable and the HELIA total score as the primary independent variable. Age, sex, educational level, employment status, and living arrangement were included as adjustment variables. Categorical variables were represented using indicator variables with specified reference categories. The final model included main effects only; interaction terms were not included.

Because heteroscedasticity was detected, regression coefficients were reported with HC3 heteroscedasticity-consistent robust standard errors and 95% confidence intervals. Model diagnostics included examination of the plot of standardized residuals against predicted values, the residual Q–Q plot, Cook's distance, and leverage values. Multicollinearity was assessed using variance inflation factors (VIFs) and tolerance values, and no evidence of problematic multicollinearity was found.

Observations with high leverage were checked for data-entry and scoring errors. Sensitivity analyses were conducted by excluding each of two high-leverage observations separately and then excluding both observations simultaneously. These analyses assessed the stability of the findings and were not used as a basis for excluding observations from the primary analysis.

All tests were two-sided, and a significance level of 0.05 was used. For robust regression estimates, p-values, 95% confidence intervals, and effect-size estimates were reported.

2. Results

A total of 193 older adults with type 2 diabetes were included. The mean age was 67.33 years (SD=5.88); 107 participants (55.4%) were men and 86 (44.6%) were women. The most common educational category was high school (82 participants, 42.5%), and the most common employment category was retired (99 participants, 51.3%). Most participants lived with their spouse and children (110, 57.0%). Health professionals were the main source of health information for 174 participants (90.2%) (Table 1).

Table 1. Participants' personal and background information in the research (N= 193)

Variables	Sub-group	N (%)
Gender	Female	86 (44.6)
	Male	107 (55.4)
Education levels	Illiterate	32 (16.6)
	At the level of reading and writing	7 (3.6)
	Elementary	63 (32.6)
	High school	82 (42.5)
	University	9 (4.7)
Type of living	Alone	5 (2.6)
	with Spouse	60 (31.1)
	with Spouse and children	110 (57.0)
	with child	18 (9.3)
Job	Housewife	76 (39.4)
	Retired	99 (51.3)
	Other	18 (9.3)
Health information source	Asking healthcare staff	174 (90.2)
	Internet	2 (1.0)
	Telephone	2 (1.0)
	Radio and television	10 (5.2)
	Asking friends	5 (2.6)
Age	Mean±SD	67.33 ± 5.88

The mean HELIA total score was 80.95 (SD=13.74). Based on the study classification, 9 participants (4.7%) had inadequate health literacy, 19 (9.8%) had marginal health literacy, 68 (35.2%) had adequate health literacy, and 97 (50.3%) had excellent health literacy (Table2).

The mean SASE total score was 69.91 (SD=7.32), with observed scores ranging from 47 to 85. Because SASE scores were not normally distributed, the median and interquartile range should also be reported (Table2).

Table 2. Descriptive statistics for health literacy and self-care ability

Variable	Dimensions	Mean ± SD	Minimum	Maximum
Health Literacy	Total Score	80.95 ± 13.74	38.93	100
	Reading	68.91 ± 27.78	0	100
	Access	87.76 ± 17.61	20.83	100
	Understanding	90.91 ± 17.02	21.43	100
	Appraisal	76.94 ± 16.96	25	100
	Decision-making	80.24 ± 10.64	22.92	100
	Inadequate	9	4.7 %	
	Marginal	19	9.8 %	
	Adequate	68	35.2 %	
	Excellent	97	50.3 %	
Self-Care Ability	Total Score	69.91 ± 7.32 Median [Q1 , Q3] 69 [66 , 74]	47	85

In bivariate analyses, the mean HELIA score was 82.40 among participants younger than 70 years and 78.35 among those aged 70 years or older (p=0.049). Men had higher mean HELIA scores than women (84.47 vs. 76.57; p<0.001). HELIA scores differed significantly across educational groups (p<0.001), whereas the difference by living arrangement was not statistically significant (p=0.135) (Table3).

Self-care ability was significantly higher among participants aged less than 70 years than among those aged 70 years and older (71.27 ± 6.92 vs. 67.46 ± 7.44, respectively; t = 3.57, p < 0.001). Nonparametric tests indicated no statistically significant differences by sex (p=0.119) or living arrangement (p=0.108). SASE scores differed significantly across educational groups (p<0.001), and the overall comparison by employment status was also statistically significant (p=0.036) (Table4).

Table 3. Relationship between demographic variables with Health Literacy

Variables	Sub-group	Health Literacy (Mean ± SD)						Statistical test	p-Value
		Reading	Access	Understanding	Appraisal	Decision-making	Total		
Age(y)	Less than 70	71.42 ± 27.33	88.64 ± 16.75	93.06 ± 13.79	78.83 ± 16.17	80.04 ± 10.43	82.4 ± 12.79	t=1.97	0.049
	70 and more	64.4 ± 28.2	86.17 ± 19.09	87.06 ± 21.24	73.55 ± 17.91	80.59 ± 11.08	78.35 ± 15.05		
Gender	Female	59.3 ± 30.63	85.37 ± 20.6	86.21 ± 19.77	75.44 ± 17.41	76.55 ± 9.87	76.57 ± 15.18	t=4.01	<0.001
	Male	76.64 ± 22.59	89.68 ± 14.6	94.69 ± 13.38	78.15 ± 16.57	83.2 ± 10.35	84.47 ± 11.36		
Education levels	Illiterate	28.91 ± 9.22	75.78 ± 24.31	70.98 ± 24.15	66.6 ± 18.42	75.91 ± 6.75	63.64 ± 11.4 [a]	F=34.11	<0.001
	At the level of reading and writing	38.39 ± 28.05	93.45 ± 13.79	94.9 ± 5.4	76.79 ± 16.02	81.55 ± 9.04	77.02 ± 8.72 [ab]		
	Elementary	66.87 ± 22.1	87.43 ± 15.29	91.5 ± 14.23	70.24 ± 14.27	79.63 ± 9.72	79.13 ± 11.38 [b]		
	High school	85.75 ± 16.53	91.97 ± 13.04	97.74 ± 7.07	85.75 ± 12.7	82.09 ± 10.55	88.66 ± 8.31 [c]		
	University	95.83 ± 8.84	89.81 ± 26.2	92.46 ± 22.62	80.56 ± 24.3	81.94 ± 22.41	88.12 ± 18.99 [c]		
Type of living	Alone	50 ± 25	88.33 ± 12.64	81.43 ± 18.45	73.75 ± 14.25	81.67 ± 1.74	75.04 ± 11.83	F=1.88	0.135
	with Spouse	68.54 ± 28.4	90.21 ± 14.87	92.26 ± 15.4	77.81 ± 16.25	82.67 ± 9.25	82.3 ± 12.99		

	with Spouse and children	73.13 ± 26.14	86.17 ± 18.57	91.2 ± 17.43	77.05 ± 17.7	80.09 ± 10.95	81.53 ± 14.04		
	with child	49.65 ± 27.82	89.12 ± 21.11	87.3 ± 19.38	74.31 ± 16.17	72.57 ± 11.3	74.59 ± 13.69		
Job	Housewife	55.59 ± 30.42	83.88 ± 21.39	84.59 ± 20.43	74.34 ± 17.22	75.85 ± 9.23	74.85 ± 15.1 [a]	F=17.92	<0.001
	Retired	80.18 ± 20.07	91.08 ± 13.59	96.03 ± 10.64	80.11 ± 15.73	83.67 ± 10.58	86.21 ± 10 [b]		
	Other	63.19 ± 27.28	85.88 ± 16.86	89.48 ± 21.09	70.49 ± 19.51	79.86 ± 10.13	77.78 ± 14.56 [b]		

t: independent t-test F: ANOVA a, b, c: Different letters indicate differences in mean values between groups.

Table 4. Relationship of demographic variables with Self-Care Ability

Variables	Sub-group	Self-Care Ability (Mean ± SD)	Statistical test	p-Value
Age(y)	Less than 70	71.27 ± 6.92	t=3.57	<0.001
	70 and more	67.46 ± 7.44		
Gender	Female	68.99 ± 8.29	U=4000.5	0.119
	Male	70.65 ± 6.38	Z=-1.560	
Education levels	Illiterate	65.72 ± 9.09 [a]	K-W =25.60	<0.001
	At the level of reading and writing	67.14 ± 1.35 [ac]		
	Elementary	68.68 ± 6.03 [ac]		
	High school	71.98 ± 6.24 [bc]		
	University	76.78 ± 10.13 [bc]		
Type of living	Alone	78.00 ± 9.17	K-W=6.08	0.108
	with Spouse	68.88 ± 7.48		
	with Spouse and children	70.17 ± 7.17		
	with child	69.50 ± 6.19		
Job	Housewife	68.62 ± 8.50 [a]	K-W =6.62	0.036
	Retired	71.15 ± 6.15 [b]		
	Other	68.56 ± 7.08 [ab]		

t: independent t-test U=Mann-Whitney U K-W: Kruskal-Wallis a, b, c: Different letters indicate differences in mean values between groups.

Spearman's rank correlation between the HELIA total score and the SASE total score was 0.430 ($p<0.001$), indicating a moderate positive association. All five HELIA domains were also positively correlated with SASE. Among the domains, appraisal had the largest correlation coefficient ($\rho=0.348$), whereas decision-making/application had the smallest ($\rho=0.258$) (Table5).

Table 5. Correlation between Health Literacy and Self-Care Ability based on spearman correlation coefficient

Variables	Reading	Access	Understanding	Appraisal	Decision-making	Total Health Literacy
Total Self-Care Ability r (p)	0.344 ** (<0.001)	0.329 ** (0.001)	0.316 ** (<0.001)	0.348 ** (<0.001)	0.258 ** (<0.001)	0.430 ** (<0.001)

In the multivariable linear regression model adjusted for age, sex, educational level, employment status, and living arrangement, the HELIA total score was positively associated with the SASE total score. The regression coefficient based on HC3 robust standard errors was 0.225 (robust SE=0.049; 95% CI: 0.129 to 0.321; $p<0.001$). Thus, each one-point increase in HELIA was associated with a 0.225-point higher expected SASE score, equivalent to 2.25 points for a 10-point increase in HELIA.

After using robust standard errors, the association between age and SASE was not statistically significant ($B=-0.189$; $p=0.124$). Adjusted differences by sex and employment status were also not statistically significant. Estimates for some education and living-arrangement categories should be interpreted cautiously because some categories contained few participants and robust overall tests for these categorical factors require separate confirmation (Table6). Based on the conventional model output, $R^2=0.331$ and adjusted $R^2=0.286$. The conventional overall model test was statistically significant ($F=7.409$, $p<0.001$). Because heteroscedasticity was detected, this conventional omnibus test should not be described as a robust overall test. The final manuscript should align the reporting of the overall model and categorical-factor tests with the final inferential method used.

Table 6. Multivariable linear regression coefficients with HC3 robust standard errors

Variable	B	Robust SE	95% CI	P-value	Etha
HELIA	0.225	0.049	(0.129 , 0.321)	<0.001	0.106
Age	-0.189	0.122	(-0.429 , 0.05)	0.124	0.013
Female vs. male	-0.425	1.734	(-3.847 , 2.997)	0.807	<0.001
Illiterate vs. university education	-6.714	3.665	(-13.945 , 0.517)	0.069	0.018
Reading/writing vs. university education	-7.810	3.738	(-15.186,-0.433)	0.038	0.024
Elementary vs. university education	-6.244	3.329	(-12.812 , 0.325)	0.062	0.019
High school vs. university education	-5.495	3.416	(-12.235 , 1.426)	0.109	0.014
Living alone vs. living with a child	9.915	5.955	(-1.836 , 21.666)	0.098	0.015
Living with spouse vs. living with a child	-2.328	2.554	(-7.367 , 2.710)	0.363	0.005
Living with spouse and children vs. living with a child	-1.658	2.384	(-6.362 , 3.045)	0.487	0.003
Homemaker vs. other employment	0.779	2.711	(-4.569 , 6.128)	0.774	<0.001
Retired vs. other employment	0.311	1.987	(-3.609 , 4.231)	0.876	<0.001

Reference categories: male, university education, living with a child, and other employment. B denotes the unstandardized regression coefficient. Robust standard errors and confidence intervals were estimated using HC3. Values reported as 0.000 by SPSS should be reported as p<0.001.

The plot of standardized residuals against predicted values showed residuals scattered around zero without a clear curved or funnel-shaped pattern. The Q–Q plot and residual-normality assessments were consistent with approximate normality of the residuals. Cook's distance ranged from approximately 0.00 to 0.20, and leverage values ranged from approximately 0.02 to 0.24. Two observations with high leverage and relatively large residuals were checked for data-entry and scoring errors. As the recorded values were considered valid, the observations were not excluded solely on the basis of diagnostic statistics.

Sensitivity analyses excluding the two observations separately and together showed that the coefficient for health literacy remained positive and statistically significant in all models. These findings indicate that the positive association between health literacy and self-care ability was not materially affected by the two observations. Therefore, the primary model retained the full sample, and the reduced-sample models were used only to assess the robustness of the findings (Table7).

Table7. Sensitivity analysis of the HELIA coefficient

Model	n	HELIA B	Robust SE	95% CI	P-value
Primary model, all participants	193	0.225	0.049	(0.129 , 0.321)	<0.001
Excluding observation 47	192	0.212	0.048	(0.117 , 0.307)	<0.001
Excluding observation 111	192	0.235	0.050	(0.137 , 0.334)	<0.001
Excluding both observations	191	0.223	0.049	(0.126 , 0.320)	<0.001

3. Discussion

The present study was conducted with the aim of investigating the association between health literacy and self-care ability in elderly patients with diabetes in Ahvaz City. The findings of the present study showed that the mean health literacy score among elderly patients with diabetes was relatively high (80.95±13.74), and more than half of the participants (50.3%) were at the "excellent" level. This result indicates that, in the study population, the ability to receive and process health information is at a favorable level. One possible reason for this status is the elderly's frequent visits to comprehensive health centers and their receipt of services from healthcare staff. Previous studies have also shown that, among elderly individuals with chronic diseases, direct interaction with healthcare providers is considered the most important source of health literacy promotion and plays an important role in improving disease comprehension (10,31). In examining the dimensions of health literacy, the highest mean scores were related to "comprehension" (90.91) and "access" (87.76), while the "reading" dimension (68.91) was lower than the other dimensions.

This pattern suggests that the elderly is better able to receive and comprehend information through verbal communication and direct interaction than through text-based skills. This finding is consistent with Nutbeam's conceptual model of health literacy, which defines health literacy as a multidimensional concept comprising functional, interactive, and critical skills (35). This result differs somewhat from the findings of a study conducted on 375 elderly diabetic patients in Iran; in their study, the mean health literacy score was reported to be lower, with the highest score related to the decision-making/behavior dimension and the lowest related to the reading dimension (30). In the present study as well, the reading dimension had the lowest mean score (68.91±27.78), which is consistent with this finding. The low score on the reading dimension in both studies likely reflects the low level of education among the elderly population in Iran.

This finding indicates that the elderly has a relatively good ability to comprehend the health information presented to them, but their ability to read and independently locate information is weaker. This distinction is particularly important from a health education standpoint, as it suggests that verbal, face-to-face education would be more effective than text-based education in this population.

This result is consistent with the findings of Sayadi et al. in their review of self-care and health literacy among the elderly in Iran, which showed that Iranian elderly individuals perform more poorly in the functional and reading dimensions of health literacy than in the other dimensions (36).

Self-care ability in this study was at a moderate-to-high level (69.91±7.32). Despite a relatively adequate level of health literacy, a notable gap was observed between "knowing" and "doing." This finding suggests that health literacy alone is not sufficient to ensure appropriate self-care behaviors. Previous studies have also emphasized that self-care in diabetes is influenced by multiple factors, including social support, psychological status, and the complexity of treatment (37-38). The results showed that age, sex, education, and occupation were significantly associated with health literacy. Individuals under 70 years of age had higher health literacy than older individuals ($p=0.049$). This finding is consistent with existing evidence indicating that increasing age is associated with declining health literacy, likely due to reduced cognitive function and limitations in information processing (31) . Men also had higher health literacy than women ($p<0.001$), which may stem from sociocultural differences in access to health information. Another important finding was the strong association between education level and health literacy ($p<0.001$). This finding is consistent with the results of extensive studies showing that education level is one of the strongest predictors of health literacy (10,31,39,40). Individuals with higher education have a greater ability to comprehend, analyze, and use health information, which may support better disease-related decision-making. age, education, and occupation were significantly associated with self-care ability. Younger individuals (under 70 years) and those with higher education showed greater self-care ability ($p<0.001$). This finding is consistent with previous studies showing that self-care in diabetes is directly influenced by socioeconomic factors and level of education (27). The World Health Organization also emphasizes that self-care ability in chronic diseases is strongly dependent on an individual's health literacy and social circumstances (41).

The most important finding of the present study was the presence of a positive and significant relationship between health literacy and self-care ability ($r=0.430$, $p<0.001$). This relationship was also observed across all dimensions of health literacy ($r=0.258$ to $r=0.348$). These results indicate that increased ability in accessing, understanding, appraising, and making decisions about health information leads to improved self-care behaviors in diabetic patients. This finding is consistent with numerous studies that have shown health literacy to be an important predictor of self-care behaviors in diabetes (28-42). In a study of 400 elderly diabetic patients in Alexandria, Egypt, a positive and significant association was reported between health literacy and self-care activities, identifying health literacy as a significant predictor of self-care in the elderly (29). A study conducted in Tehran also showed that low health literacy in patients with type 2 diabetes is a fundamental barrier to improving self-care (43). Another study found that health literacy promotion programs could improve self-care behaviors and quality of life in rural diabetic patients (44). Together, this evidence confirms that health literacy plays a central role in empowering chronically ill patients toward self-care. However, the moderate strength of this correlation suggests that health literacy alone is not the sole determinant of self-care, and that other factors such as social support, treatment complexity, and psychological status also play a role. This has also been confirmed in systematic reviews, which indicate that the relationship between health literacy and self-care behaviors is not always complete and direct, and is influenced by mediating variables (27). In summary, the findings of this study indicate that although health literacy is at a favorable level among the elderly participants studied, translating this literacy into practical self-care behavior remains a significant challenge. These findings underscore the necessity of addressing health literacy as a key factor in promoting self-care among elderly diabetic patients. Given that healthcare personnel are the most important source of information for this group, the design and implementation of simple, visual educational programs tailored to the literacy level of the elderly by healthcare providers particularly with a focus on more vulnerable groups such as women, illiterate individuals, and the oldest-old could be an effective step toward improving self-care and reducing diabetes-related complications in this population.

4. Conclusion

The findings of this study showed that, despite a relatively favorable level of health literacy among elderly patients with diabetes in Ahvaz City, their self-care ability remained at a moderate level; this finding reflects a gap between knowledge and practice in this population. Given the significant association between health literacy and self-care ability, and the central role of healthcare personnel as the primary source of health information for the elderly, the design and implementation of simple, verbal educational programs tailored to the literacy level of older adults particularly with a focus on more vulnerable groups such as women, illiterate individuals, and the oldest-

old is recommended. Future intervention studies are needed to assess the effectiveness of such programs in improving self-care in this population.

Limitations

Participants were a convenience sample from a single center in Ahvaz, and 90.2% relied on healthcare staff for health information, suggesting selection bias and limited generalizability. All data were self-reported and may be affected by recall and social desirability bias. The SASE measures general self-care ability, not diabetes-specific self-care behaviors. Future studies should use probability sampling across multiple centers, diabetes-specific measures, and longitudinal designs.

Footnotes

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