Investigation of the Relationship Between Health Literacy and Self-Care Agency in Patients with Type 2 Diabetes: A Descriptive and Correlational Study

Tip 2 Diyabet Hastalarında Sağlık Okuryazarlığı ile Öz Bakım Gücü Arasındaki İlişkinin İncelenmesi: Tanımlayıcı ve Korelasyonel Bir Çalışma

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ABSTRACT

Objective: This study aimed to examine the relationship between health literacy and self-care agency in patients with type 2 diabetes.

Materials and Methods: This descriptive and correlational study was conducted with 128 patients diagnosed with type 2 diabetes who were receiving treatment in the internal medicine clinics of a city hospital. Data were collected by the researcher between July 2021 and February 2022 using the Descriptive Characteristics Form, the Diabetes Health Literacy Scale, and the Diabetes Self-Care Agency Scale.

Results: The mean total score on the Diabetes Health Literacy Scale was 34.07 ± 11.75. The subscale scores were as follows: Functional Health Literacy – 12.39 ± 4.95, Interactive Health Literacy – 7.20 ± 3.05, and Critical Health Literacy – 14.46 ± 5.82. The mean total score on the Diabetes Self-Care Agency Scale was 82.19 ± 12.97. A statistically significant, positive, moderate correlation was found between the total self-care agency score and the total score, interactive, and critical subscale scores of the health literacy scale ($p < 0.001$).

Conclusions: The participants demonstrated moderate levels of both health literacy and self-care agency. Health literacy is a key factor in the management of chronic diseases such as diabetes, as it influences individuals' ability to access information, make informed decisions, adhere to treatment, and maintain quality of life. Enhancing health literacy is essential for improving self-care capacity and the sense of personal responsibility in disease management.

Keywords: Chronic disease management, health literacy, nursing, self-care agency, type 2 diabetes

ÖZ

Amaç: Bu çalışma, tip 2 diyabet tanısı almış bireylerde sağlık okuryazarlığı ile öz bakım gücü arasındaki ilişkiyi incelemek amacıyla yapılmıştır.

Materyal ve Metot: Tanımlayıcı ve ilişki arayıcı nitelikteki bu araştırma, bir şehir hastanesinin dahiliye kliniklerinde tedavi gören 128 tip 2 diyabet hastası ile yürütülmüştür. Veriler, Temmuz 2021 – Şubat 2022 tarihleri arasında araştırmacı tarafından "Tanıtıcı Özellikler Formu", "Diyabet Sağlık Okuryazarlığı Ölçeği" ve "Diyabet Öz Bakım Gücü Ölçeği" kullanılarak toplanmıştır.

Bulgular: Diyabet Sağlık Okuryazarlığı Ölçeği toplam puan ortalaması $34,07 \pm 11,75$ olarak bulunmuştur. Alt boyut ortalama puanları sırasıyla; Fonksiyonel Sağlık Okuryazarlığı $12,39 \pm 4,95$, Etkileşimsel Sağlık Okuryazarlığı $7,20 \pm 3,05$ ve Eleştirel Sağlık Okuryazarlığı $14,46 \pm 5,82$'dir. Diyabet Öz Bakım Gücü Ölçeği toplam puan ortalaması ise $82,19 \pm 12,97$'dir. Sağlık okuryazarlığı ile öz bakım gücü arasındaki ilişki incelendiğinde; Öz Bakım Gücü Ölçeği toplam puanı ile Sağlık Okuryazarlığı Ölçeği' nin toplam, etkileşimsel ve eleştirel alt boyut puanları arasında orta düzeyde, pozitif ve anlamlı bir ilişki saptanmıştır ($p < 0,001$).

Sonuç: Araştırmaya katılan bireylerin sağlık okuryazarlığı ve öz bakım gücü düzeylerinin orta seviyede olduğu belirlenmiştir. Sağlık okuryazarlığı, diyabet gibi kronik hastalıkların yönetiminde önemli bir faktördür ve bireylerin hastalığıyla ilgili bilgiye ulaşma, karar verme, tedaviye uyum sağlama ve yaşam kalitesini sürdürme becerilerini doğrudan etkilemektedir. Bu nedenle, bireylerin öz bakım becerilerinin ve sorumluluklarının artırılması için sağlık okuryazarlığının geliştirilmesi önem taşımaktadır.

Anahtar Kelimeler: Hemşirelik, kronik hastalık yönetimi, öz bakım gücü, sağlık okuryazarlığı, tip 2 diyabet

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a growing global health challenge, significantly impacting individual well-being and imposing a substantial economic burden on healthcare systems worldwide.[1,2] The rising prevalence of diabetes necessitates effective management strategies. Recent global estimates indicate that approximately 537 million adults were living with diabetes in 2021, with projections suggesting this number could reach 783 million by 2045.[2] The increasing incidence of T2DM, particularly in developing countries, requires proactive, evidence-based interventions.[3,4]

Active patient engagement in self-care behaviors is central to effective T2DM management. These behaviors include blood glucose monitoring, dietary adherence, physical activity, medication compliance, and problem-solving skills.[5] However, many diabetic individuals have suboptimal self-care, leading to poor disease control, higher complication risks, and reduced quality of life.[6,7]

Health literacy profoundly influences an individual's capacity to manage chronic conditions like T2DM. It encompasses the cognitive and social skills to access, understand, appraise, and apply health information for informed decisions.[8,9] This skill directly supports self-care adherence and significantly impacts diabetes outcomes.[5,6] Low health literacy is linked to poorer health status, increased hospitalization rates, and higher healthcare expenditures.[7] Conversely, individuals with adequate health literacy are more likely to effectively use health services and make informed decisions.[8] Modern healthcare systems' complexity demands advanced health literacy skills, including critical appraisal of health information and effective self-care management.[10] Therefore, developing interventions to enhance health literacy is vital for empowering T2DM patients in their disease management. Various educational approaches have been explored to improve health literacy and self-care in diabetic populations, including structured education programs and effective communication strategies.[11,12]

Despite growing research on health literacy in T2DM management, significant gaps persist. Many cross-sectional studies limit causal determination.[13,14] Unmet needs for information and support in disease management remain prevalent among T2DM patients, indicating a gap between current educational efforts and patient comprehension.[5,6]

These challenges emphasize the need for ongoing research to develop more effective, culturally sensitive, and accessible health literacy interventions that empower T2DM individuals to achieve optimal self-care and glycemic control. This study provides a current synthesis of evidence to inform future research and clinical practice. This study aimed to investigate the relationship between health literacy and self-care agency among patients with type 2 diabetes.

MATERIALS AND METHODS

Ethical Considerations: The study granted an Institutional Review Board approval from Süleyman Demirel University Health Sciences Ethics Committee (Date:11.08.2021, decision no: 52/2). Institutional permits were obtained from State Hospital (date: 22.09.2021). This study followed the principles of the Declaration of Helsinki. All participants provided written informed consent.

Design: This study aimed to examine the relationship between health literacy and self-care power of type 2 diabetes patients. The research was planned as descriptive and correlational. Research Questions:

- What are the health literacy levels and self-care agency of type 2 diabetes patients?
- Is there a relationship between the health literacy level of type 2 diabetes patients and sociodemographic characteristics?
- Is there a relationship between health literacy level and self-care agency of type 2 diabetes patients?

Participants: The study population included individuals diagnosed with type 2 diabetes for at least one year. Demographic analysis revealed that participants had a mean age of 58.53±10.19 years (range: 33-90 years). The majority were female (n=78, 60.9%), married (n=103, 80.5%), and had primary school education (n=68, 53.1%). Most participants were unemployed (n=65, 50.8%), and 78.1% (n=100) reported income equal to expenditure. Inclusion criteria were a T2DM diagnosis for at least one year, literacy, no speech or hearing impairments, and consent to participate. Exclusion criteria were the patient's desire to leave the study. The sample size was determined as 128 people with a 95% confidence interval, 5% margin of error, 0.25 effect size (based on previous correlation studies examining health literacy and self-care relationships in diabetic populations,[13,15] 0.25% effect size and 80% power with the G power (3.1) program.

Instruments: The data of the study were collected by using the "Descriptive Characteristics Form", "Health Literacy Scale in Adult Patients with Diabetes (HLS)" and Diabetes Self-Care Scale (DSCS). Descriptive Characteristics Form was prepared by the researchers by reviewing the relevant literature.[16,17] The form consists of 24 questions in total. It includes gender, age, marital status, education status, employment status, income status, habits (alcohol and smoking), duration of diabetes, exercise-diet information, education status and educational needs,

frequency of doctor visits, complication status, treatment compliance, and comorbid chronic diseases.

Health Literacy Scale in Adult Patients with Diabetes consists of 14 items grouped into three subscales: functional (5 items), communicative (5 items), and critical (4 items) health literacy. Each item is rated on a 4-point Likert scale (never–often) (Cronbach's α = 0.78).[18] The functional subscale is reverse-scored, whereas the communicative and critical subscales are scored directly from 1 to 4. Higher scores on the total scale and subscales reflect better health literacy. In the Turkish validation study, the internal consistency coefficient (Cronbach's α) was 0.96 for the total scale, and 0.96, 0.91, and 0.96 for the functional, communicative, and critical subscales, respectively.[17] In this study, Cronbach's α was 0.94, indicating excellent reliability.

Diabetes Self-Care Scale developed by Lee and Fisher, is a 35-item, 4-point Likert-type instrument designed to assess self-care behaviors in individuals with type 2 diabetes mellitus.[19] The scale covers multiple domains, including dietary habits, physical activity, blood glucose monitoring and recording, adherence to oral antidiabetic or insulin therapy, medical follow-ups, foot care, personal hygiene, and knowledge of diabetes-related complications. Total scores range from 35 to 140, with higher scores indicating better self-care performance; scores above 92.4 are considered to represent an adequate level of self-care. The Turkish adaptation study reported a Cronbach's α of 0.81.[16] In this study, Cronbach's alpha was 0.84.

Data Collection: The study's data were collected between July 2021 and February 2022. Data were collected face-to-face through a questionnaire form. Patients who attended routine endocrinology appointments were approached and informed about the study's objectives and procedures. Written informed consent was obtained prior to data collection. The questionnaires were then administered and completed either independently by participants or with assistance from the researchers when necessary. The completion time for each participant was approximately 15 minutes. Permission to use the instruments was obtained via e-mail from the authors of the original validity and reliability studies.

Statistical Analysis: Data were analyzed using SPSS 23.0 (IBM Corp., Armonk, NY, USA). Reliability of the Diabetes Self-Care Scale and the Health Literacy in Adult Patients with Diabetes Scale (and subscales) was evaluated with Cronbach's alpha. Normality was assessed using the Shapiro–Wilk test and Q–Q plots, revealing non-normal distribution (p<0.001). Consequently, non-parametric tests were applied. Descriptive statistics were presented as percentages, means, standard deviations, and mean ranks. The Mann–Whitney U test was used for two-group comparisons, and the Kruskal–Wallis H test for comparisons involving more than two groups. Post hoc pairwise comparisons were performed using Dunn's test with Bonferroni correction. Correlations between scales were analyzed using Spearman's rank correlation coefficient. Statistical significance was set at p<0.05.

RESULTS

The study investigated health literacy and self-care behaviors in individuals with Type 2 Diabetes Mellitus (T2DM). The mean Health Literacy Scale (HLS) total score was 34.07±11.75, with subscale scores for Functional, Interactive, and Critical Health Literacy being 12.39±4.95, 7.20±3.05, and 14.46±5.82, respectively. The mean Diabetes Self-Care Scale total score was 82.19±12.97 (Table 1). Based on the Turkish validation study of the HLS,[17] total scores between 28-42 are classified as moderate health literacy, scores below 28 as low, and scores above 42 as high health literacy. Similarly, for the Diabetes Self-Care Scale, scores between 70-92 represent moderate self-care capacity, scores below 70 indicate low capacity, and scores above 92 suggest adequate self-care capacity.[16]

Table 1. Health literacy and self-care scores of adults with diabetes (n=128).

Variables		Mean ± SD	Min-Max.	α
Diabetes Self-Care Scale		82.19 ± 12.97	59.00-114.00	0.840
Health Literacy Scale (HLS) Total Score in Adult Patients with Diabetes		34.07 ± 11.75	14.00-56.00	0.936
Sub-dimensions	Functional health literacy	12.39 ± 4.95	5.00-20.00	0.929
	Interactive health literacy	7.20 ± 3.05	3.00-12.00	0.862
	Critical health literacy	14.46 ± 5.82	6.00-24.00	0.925

SD: Standard Deviation; Min.: Minimum; Max.: Maximum; α: Cronbach's alpha; Based on established cut-off points: HLS total scores 28-42 = moderate literacy; DSCS scores 70-92 = moderate self-care capacity.

A statistically significant difference was found between education level and HLS total and subdimension scores (p=0.0001). Participants with a university education or higher exhibited significantly greater health literacy. Actively employed participants demonstrated significantly higher health literacy levels compared to unemployed or retired individuals (p=0.0001). Individuals with incomes exceeding expenses showed significantly higher health literacy levels (p=0.001). Functional health literacy was significantly higher in participants with a diabetes duration of 1-5 years compared to those with longer durations (p=0.040). Participants who attended diabetes control visits monthly had significantly higher health literacy levels (p=0.014). Participants without a history of chronic complications exhibited significantly higher functional health literacy (p=0.034). Participants who received diabetes education had significantly higher total, interactive, and critical health literacy scores (p=0.026; p=0.038; p=0.015). Knowledge about complications was significantly associated with higher levels of both health literacy and self-care (p=0.0001) (Table 2).

A negative, moderate correlation was observed between age and HLS total score (r= -0.346) and functional health literacy (r= -0.392), and a negative, low correlation with interactive and critical health literacy (r= -0.259; r= -0.229) (p=0.0001). This indicates that younger age is associated with higher health literacy levels (Table 3).

Table 2. The relationship between health literacy and self-care scores of adults with diabetes and demographic variables (n=128).

Variables		n (%)	Health Literacy Scale in Adult Patients with Diabetes				Diabetes Self-Care Scale Total Score Mean Rank
			Total Score Mean Rank	Functional Mean Rank	Critical Mean Rank	Interactive Mean Rank	
Education status	Literate	14 (10.9)	33.57	26.93	48.39	48.75	62.75
	Primary School	68 (53.1)	55.01	61.26	52.66	54.40	59.16
	Middle School	5 (3.9)	69.70	68.60	71.90	70.30	66.80
	High School	27 (21.1)	81.63	78.02	81.78	80.19	74.93
	University/ Graduate	14 (10.9)	102.61	90.29	102.14	97.00	71.25
	KW;p		KW=32.486 **p=0.0001**	KW=25.534 **p=0.0001**	KW=30.806 **p=0.0001**	KW=23.454 **p=0.0001**	KW=4.070 p=0.397
Employment status	Employed	21 (16.4)	102.12	99.79	97.00	92.10	68.45
	Unemployed	65 (50.8)	54.07	52.23	57.56	57.25	62.01
	Retired	42 (32.8)	61.83	65.85	58.99	61.92	66.38
	KW;p		KW=26.981 **p=0.0001**	KW=26.416 **p=0.0001**	KW=19.815 **p=0.0001**	KW=14.422 **p=0.001**	KW=0.642 p=0.725
Income status	Income more than expenditure	18 (14.1)	90.14	97.00	73.47	80.31	56.44
	Income equal to expenditure	100 (78.1)	62.63	61.79	64.34	63.58	67.42
	Income less than expenditure	10 (7.8)	37.10	33.15	50.00	45.30	49.80
	KW;p		KW=14.325 **p=0.001**	KW=21.699 **p=0.0001**	KW=2.649 p=0.266	KW=6.058 **p=0.048**	KW=3.050 p=0.218
Duration of diabetes	1-5 years	34 (26.6)	72.69	77.06	70.06	68.19	64.47
	6-10 years	40 (31.3)	66.74	64.55	67.00	67.18	65.35
	11 years and above	54 (42.2)	57.69	56.56	59.15	60.19	63.89
	KW;p		KW=3.630 p=0.163	KW=6.435 **p=0.040**	KW=2.122 p=0.346	KW=1.283 p=0.527	KW=0.036 p=0.982

Min: Minimum; Max: Maximum; SD: Standard Deviation; r: Pearson Correlation Coefficient; p: Significance Level; Z: Mann-Whitney U Test; KW: Kruskal-Wallis Test; Mean Rank represents the average rank position when data are ordered from lowest to highest.

Table 2. Continue.

Diabetes control	When I get sick	25 (19.5)	69.22	62.84	71.20	71.88	64.66
	Once a month	6 (4.7)	91.75	77.83	94.17	92.67	87.42
	1 time in 2 months	12 (9.4)	63.42	73.33	55.79	57.96	60.63
	1 time in 3 months	45 (35.2)	51.50	56.81	54.61	51.27	54.86
	1 time in 6 months	25 (19.5)	80.66	71.14	77.82	83.28	65.36
	1 time per year	15 (11.7)	58.67	66.87	55.90	54.57	85.67
	KW;p		KW=14.309 **p=0.014**	KW=4.342 p=0.501	KW=12.863 **p=0.025**	KW=18.179 **p=0.003**	KW=10.399 p=0.065
Presence of chronic complication	Yes	73 (57.0)	61.24	56.53	63.49	65.20	69.20
	No	55 (43.0)	66.96	70.51	65.26	63.97	60.96
	Z;p		Z=-0.864 p=0.387	Z=-2.121 **p=0.034**	Z=-0.271 p=0.787	Z=-0.186 p=0.852	Z=-1.247 p=0.213
Diabetes education	Yes	39 (30.5)	75.53	69.68	74.67	76.46	68.09
	No	89 (69.5)	59.67	62.23	60.04	59.26	62.93
	Z;p		Z=-2.227 **p=0.026**	Z=-1.051 p=0.293	Z=-2.079 **p=0.038**	Z=-2.425 **p=0.015**	Z=-0.726 p=0.468
Knowledge of complication	Yes	48 (37.5)	82.15	70.91	86.70	83.32	80.10
	No	80 (62.5)	53.91	60.66	51.18	53.21	55.14
	Z;p		Z=-4.171 **p=0.0001**	Z=-1.521 p=0.128	Z=-5.311 **p=0.0001**	Z=-4.465 **p=0.0001**	Z=-3.693 **p=0.0001**

Min: Minimum; Max: Maximum; SD: Standard Deviation; r: Pearson Correlation Coefficient; p: Significance Level; Z: Mann-Whitney U Test; KW: Kruskal-Wallis Test; Mean Rank represents the average rank position when data are ordered from lowest to highest.

Table 3. The relationship between health literacy and self-care scores of adults with diabetes and various variables (n=128).

Variables	Mean ± SD (Min-Max)	Health Literacy Scale in Adult Patients with Diabetes				Diabetes Self-Care Scale Total Score r, p
		Total Score r, p	Functional r, p	Critical r p	Interactive r, p	
Age (years)	58.53±10.19 (33-90)	r=-0.346 **p=0.0001**	r=-0.392 **p=0.0001**	r=-0.259 **p=0.003**	r=-0.229 **p=0.009**	r=-0.041 p=0.648
Number of cigarettes consumed per day (number)	0.33±1.83 (0-20)	r=-0.053 p=0.551	r=-0.001 p=0.989	r=-0.002 p=0.980	r=-0.105 p=0.238	r=-0.015 p=0.868
Amount of alcohol consumed per day (glasses)	0.00±0.08 (0-1)	r=0.068 p=0.448	r=0.083 p=0.354	r=0.052 p=0.557	r=0.039 p=0.664	r=0.191 **p=0.031**
BMI	29.43±4.06 (21.82-43.55)	r=0.074 p=0.406	r=0.061 p=0.495	r=0.065 p=0.464	r=0.064 p=0.476	r=-0.231 **p=0.009**
HBA1c	7.88±1.91 (5.30-16.30)	r=-0.011 p=0.904	r=-0.094 p=0.290	r=0.069 p=0.436	r=0.022 p=0.805	r=0.086 p=0.334

Min: Minimum; Max: Maximum; SD: Standard Deviation; r: Pearson Correlation Coefficient; p: Significance Level.

Finally, a positive, medium-level correlation was found between the Diabetes Self-Care Scale total score and HLS total, interactive, and critical health literacy sub-dimension scores (r= 0.330; r= 0.342; r=0.348, respectively; p=0.0001). A positive, low-level correlation was also noted with functional health literacy (r= 0.164; p=0.065). These results suggest that as health literacy increases, self-care levels also tend to increase (Table 4).

Table 4. The relationship between health literacy and self-care levels of adults with diabetes (n=128).

Variables		HLS Total Score	HLS Functional	HLS Interactive	HLS Critical
Diabetes Self-Care Scale	r	0.330	0.164	0.342	0.348
Total Score	p	**0.0001**	0.065	**0.0001**	**0.0001**

HLS: Health Literacy Scale in Adult Patients with Diabetes; r: Pearson Correlation Coefficient.

DISCUSSION AND CONCLUSION

This study found a moderate, positive, and statistically significant relationship between the health literacy levels and self-care abilities of individuals with T2DM (r=0.330, p=0.0001). This finding aligns with the literature, which shows health literacy's central role in diabetes management. Numerous national and international studies conducted between 2018-2021 have consistently shown that as health literacy levels increase, individuals' capacity to adopt and maintain self-care behaviors also rises in parallel.[20-22]

The correlation coefficient obtained in our study (r=0.330), when compared to other studies in the literature, suggests that the strength of this relationship may vary across different populations and contexts. For example, studies conducted during 2020-2023 reported varying correlation strengths. A study with elderly diabetic patients reported a stronger correlation (r=0.514) between health literacy and self-care practices,[23] while another study found this relationship to be even more pronounced (r=0.76).[13] In contrast, another Turkish study found a weaker relationship (r=0.15).[24] These differences may stem from the different measurement tools used in the studies, variations in sample sizes and demographic characteristics (age, education level, etc.), and the influence of the socio-cultural context. Despite varying correlation coefficients, all studies show a positive, significant relationship between health literacy and self-care. This strengthens the hypothesis that health literacy improves self-care by enhancing the ability to understand, evaluate, and apply health information.[8,25]

An important finding of our study was that interactive and critical health literacy dimensions showed stronger correlations with self-care (r=0.342 and r=0.348, respectively) compared to functional health literacy (r=0.164). This pattern suggests that in diabetes management, the ability to engage in meaningful dialogue with healthcare providers (interactive literacy) and critically evaluate health information (critical literacy) may be more crucial than simply reading and understanding basic health materials (functional literacy). This finding aligns with the contemporary understanding that effective diabetes self-management requires not just information acquisition, but also the capacity to question, discuss, and make informed decisions about one's care.[10,26] The stronger association of interactive and critical literacy with self-care emphasizes the need for diabetes education programs to move beyond simple information transmission and foster patients' critical thinking, problem-solving abilities, and communication skills with healthcare providers.

In our study, it was observed that sociodemographic factors such as age, education, income, and employment status have a significant effect on health literacy levels. In particular, the higher health literacy scores of younger, highly educated, actively employed individuals with higher income levels are consistent with findings in the literature.[6,23] This situation demonstrates that health literacy is not only an individual skill but is also closely related to social and economic determinants. Educational level increases individuals' critical thinking and information processing skills, while better economic conditions facilitate access to health services and educational materials. Furthermore, with the innovations brought about by the digital age, the concept of e-health literacy has also gained importance. Studies published in 2024-2025 show that e-health literacy, which is the ability to access and use health information via the internet and mobile technologies, is also positively related to self-care behaviors and is influenced by demographic factors, just like traditional health literacy.[6,27] Therefore, considering these sociodemographic differences and the digital divide when planning diabetes education programs is critical for the effectiveness of interventions.

The findings of this study provide valuable insights into the roles of nurses and other healthcare profes-

sionals in diabetes management. The proven impact of health literacy levels on self-care capacity emphasizes that diabetes education should be personalized according to individuals' literacy levels, learning capacities, and socio-cultural backgrounds rather than following a standard approach. As stated by the American Association of Diabetes Educators, providing education tailored to patients' literacy levels is a fundamental condition for improving treatment adherence and self-care success.[28] In this context, the use of methods such as "teach-back" can be an effective strategy to confirm whether the patient has correctly understood the information provided.[29] Additionally, healthcare professionals should support patients' e-health literacy by directing them to reliable online health resources and teaching them how to critically evaluate these sources.

This study has some limitations. First, since the data were collected from a single center (city hospital), the generalizability of the results to diabetic individuals in different geographic regions or at different levels of healthcare (e.g., primary care) may be limited. Second, the use of self-report scales in the data collection process may have led to social desirability bias; that is, participants may have reported higher levels of self-care behaviors than they actually perform, potentially overestimating the true relationship between health literacy and self-care. Future studies should consider incorporating objective measures of self-care (such as medication adherence monitoring or HbA1c levels) alongside self-reported measures to minimize this bias. Third, the cross-sectional design limits our ability to establish causal relationships between health literacy and self-care behaviors.

In conclusion, this study revealed a significant and positive relationship between health literacy and self-care agency in individuals with T2DM, with interactive and critical health literacy dimensions showing particularly strong associations with self-care behaviors. Participants demonstrated moderate levels of both health literacy and self-care agency. The findings reaffirm that health literacy, particularly its interactive and critical dimensions, is crucial for successful diabetes management. Based on these findings, we recommend that:

1. Healthcare professionals, especially nurses, should routinely assess health literacy levels and integrate these assessments into personalized care planning.

2. Diabetes education programs should emphasize developing interactive and critical health literacy skills, focusing on effective communication with healthcare providers and critical evaluation of health information, rather than solely on basic information transmission.

3. Educational interventions should be designed con-

sidering sociodemographic factors and should address e-health literacy needs in the digital age.

4. Evidence-based communication techniques such as "teach-back" should be standardized to ensure patient understanding.

Future research should employ longitudinal and experimental designs to examine the long-term effects of health literacy interventions on self-care behaviors and glycemic control. Multicenter studies across diverse cultural and socioeconomic contexts are needed to enhance the generalizability of findings.

REFERENCES

1. World Health Organization. World health statistics 2024: Monitoring health for the SDGs, sustainable development goals. Geneva, Switzerland: World Health Organization; 2024. http://www.who.int Accessed June 28, 2025.

2. International Diabetes Federation. IDF Diabetes Atlas 11th Edition-2025. Brussels, Belgium: International diabetes federation; 2025. https://diabetesatlas.org/ Accessed June 25, 2025.

3. Coyle ME, Francis K, Chapman Y. Self-management activities in diabetes care: a systematic review. Aust Health Rev. 2013;37(4):513-522. doi:10.1071/AH13060

4. Mogre V, Johnson NA, Tzelepis F, Paul C. Barriers to diabetic self-care: A qualitative study of patients' and healthcare providers' perspectives. J Clin Nurs. 2019;28(11-12):2296-2308. doi:10.1111/jocn.14835

5. ALSharit BA, Alhalal EA. Effects of health literacy on type 2 diabetic patients' glycemic control, self-management, and quality of life. Saudi Med J. 2022;43(5):465-472. doi:10.15537/smj.2022.43.5.20210917

6. Sadeghi S, Borzu ZA, Shirzadi S, Jahanfar S, Abadi YG, Taziki M. Investigating e-health literacy and its relationship with self-care behaviors among Iranian middle-aged type 2 diabetes: a cross-sectional study. BMC Public Health. 2025;25(1):1376. doi:10.1186/s12889-025-22648-w

7. Butayeva J, Ratan ZA, Downie S, Hosseinzadeh H. The impact of health literacy interventions on glycemic control and self-management outcomes among type 2 diabetes mellitus: A systematic review. J Diabetes. 2023;15(9):724-735. doi:10.1111/1753-0407.13436

8. Tørris C, Nortvedt L. Health literacy and self-care among adult immigrants with type 2 diabetes: a scoping review. BMC Public Health. 2024;24(1):3248. doi:10.1186/s12889-024-20749-6

9. Tawfik MY, Mohamed RA, Elsaid NMAB. Pathways linking health literacy to diabetes risk scores in a non-diabetic population in Ismailia, Egypt: a cross sectional study design. BMC Public Health. 2025;25(1):2170. doi:10.1186/s12889-025-23526-1

10. Nutbeam D, Muscat DM. Health promotion glossary 2021. Health Promotion Int. 2021;36(6):1578–1598. doi:10.1093/heapro/daab067

11. Correia JC, Fakih El Khoury C, El Chaar D, et al. Use of digital self-care solutions for diabetes long-term management: a scoping review protocol. BMJ Open. 2025;15(10):e100506. doi:10.1136/bmjopen-2025-100506

12. White RO, Chakkalakal RJ, Presley CA, et al. Perceptions of provider communication among vulnerable patients with diabetes: influences of medical mistrust and health literacy. J Health Commun. 2016;21(sup2):127-134. doi:10.1080/10810730.2016.1207116

13. Ong-Artborirak P, Seangpraw K, Boonyathee S, Auttama N, Winaiprasert P. Health literacy, self-efficacy, self-care behaviors, and glycemic control among older adults with type 2 diabetes mellitus: a cross-sectional study in Thai communities. BMC Geriatr. 2023;23(1):297. doi:10.1186/s12877-023-04010-0

14. Bailey SC, Brega AG, Crutchfield TM, et al. Update on health literacy and diabetes. Diabetes Educ. 2014;40(5):581-604. doi:10.1177/0145721714540220

15. Jafari A, Moshki M, Ghelichi-Ghojogh M, Nejatian M. Role of diabetes health literacy, psychological status, self-care behaviors, and life satisfaction in predicting quality of life in type 2 diabetes. Sci Rep. 2024;14(1):1635. doi:10.1038/s41598-024-51245-x

16. Karakurt P, Kaşıkçı M. Validity and reliability of the Turkish version of the diabetes self-care scale. Int J Diabetes Dev Ctries. 2015; 35:148-156.

17. Agralı H, Akyar I. Turkish validation and reliability of health literacy scale for diabetic patients. Acıbadem Univ J Health Sci. 2018;9(3):314-21.

18. Ishikawa H, Takeuchi T, Yano E. Measuring functional, communicative, and critical health literacy among diabetic patients. Diabetes Care. 2008;31(5):874-879. doi:10.2337/dc07-1932

19. Lee NP, Fisher WP Jr. Evaluation of the Diabetes Self-Care Scale. J Appl Meas. 2005;6(4):366-381.

20. de Carvalho AC, Silva MT, Treptow ILG, et al. Health literacy in patients with Type 2 Diabetes Mellitus: A systematic review. Clinics (Sao Paulo), 2025;80: 100774. doi:10.1016/j.clinsp.2025.100774

21. Li J, Lin Y, Li X, et al. Mediating Effects of Health Literacy Between Self-Efficacy and Quality of Life in Patients with Type 2 Diabetes Mellitus. Diabetes Metab Syndr Obes. 2025;18:3625-3637. doi:10.2147/DMSO.S546698

22. Nugent TL, Galea AM, Sammut R. Health literacy, self-management and glycaemic control in persons living with type 2 diabetes mellitus: a cross-sectional study. Pract Diab, 2023;40:28-34. doi:10.1002/pdi.2467

23. Ziady HH, El-Zeiny NAE, Fetohy EM, Hew SAH, Hagras EMA. Assessment of diabetes health literacy and its predictors among diabetic older adults attending geriatric clubs, 2024. Alexandria J Med. 2025;61(1):1–10. doi:10.1080/20905068.2025.2464362

24. Dilekçi NN, Aşiret GD. Relationship Between Health Literacy and Self-Care Management of Type 2 Diabetic Patients. J Res Dev Nurs. 2025;27(2):142-156. doi:10.69487/hemarge.1582908

25. Al-Qerem W, Jarab A, Al-Qerem W, Al-Qerem W. The association between health literacy and quality of life of patients with type 2 diabetes mellitus in Jordan. PLoS ONE. 2024; 19(4): e0312833. doi:10.1371/journal.pone.0312833

26. Abdulsalam FI, Srichaijaroonpong S, Phoosuwan N, Phoosuwan N. Effectiveness of a Health Literacy and Diabetes Self-Management Education (DSME) Improvement Program for People With Type 2 Diabetes Mellitus: A Community-Based Quasiexperimental Study in Thailand. J Diabetes Res. 2025;2025:2640702. doi:10.1155/jdr/2640702

27. Mukhtar T, Babur MN, Abbas R, Irshad A, Kiran Q. Digital Health Literacy: A systematic review of interventions and their influence on healthcare access and sustainable development Goal-3 (SDG-3). Pak J Med Sci. 2025;41(3):910-918. doi:10.12669/pjms.41.3.10639

28. Jang Y, Yang Y. Effects of e-health literacy on health-related quality of life in young adults with type 2 diabetes: Parallel mediation of diabetes self-efficacy and self-care behaviors. Appl Nurs Res. 2025;82:151917. doi:10.1016/j.apnr.2025.151917

29. Roshan-Nejad M, Hosseini M, Vasli P, et al. Effect of health literacy-based teach-back training

on quality of life and treatment adherence in type 2 diabetes: an experimental study. Sci Rep 2025;15: 551. doi:10.1038/s41598-024-84399-9