REVIEW ARTICLE

Health Literacy Association With Diabetes Self-care Behaviour and Glycemic Control: A Scoping Review

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ABSTRACT

Chronic uncontrolled diabetes can lead to multiple complications that can affect quality of life but with health literacy (HL), individuals can understand and act on healthcare providers' advice and seek treatment at healthcare facilities. This brief review summarises and to discover current observational studies on association between HL and diabetes self-care behaviour and glycaemic control in individual with Type 2 *Diabetes mellitus*. The literature search was performed using four databases; Web of Science, Scopus, Google Scholar, and PubMed. The search was limited to 2018–2023 articles. This review encompassed a total of twenty studies. The results show that health literacy (HL) is strongly linked to diabetes self-care in type 2 diabetics. However, HL association with glycaemic control is inconclusive. This review indicated that individuals' HL level is needed to understand and act on health advice and seek treatment at healthcare facilities.
Malaysian Journal of Medicine and Health Sciences (2024) 20(6): 331-340. doi:10.47836/mjmhs20.6.41

Keywords: Health literacy, Type 2 *diabetes mellitus*, Glycemic control, Diabetes self-care behaviour, Healthcare provider

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INTRODUCTION

Diabetes mellitus (DM) is a global pandemic and the prevalence of DM doubled from 4.7% (108 million >18 years) to 8.5% (422 million >18 years) between 1980 and 2014 globally (1). Low and middle-income countries in the Eastern Mediterranean and Southeast Asia have a higher prevalence of diabetes than high-income countries (1). In 2017, there were 476.0 million people with diabetes worldwide, an increase of 129.7% since 1990. Without effective interventions, this number is expected to increase to 570.9 million by 2025, with 1.59 million deaths (2). 90% of the world count of *diabetes mellitus* is *Diabetes mellitus* type 2 (T2DM) and occurs by insulin deficiency and insulin resistance combined (3) and is universally associated with unhealthy diets, physical inactivity, and smoking (2). Considering the complex conditions of T2DM that necessitate self-care and correct comprehension of pharmaceutical and non-pharmacological therapies, T2DM is regarded as an excellent model to investigate the importance of health literacy to achieve satisfactory glycaemic control.

Diabetes self-care practices are actions or behaviours taken by a person who has diabetes or is at risk of developing it to manage their condition independently (4). The four main pillars of diabetes self-care are dietary intake, physical activity, medication adherence, and self-monitoring of blood glucose (SMBG) (5-7). Measuring the HbA1c level is a standard method to monitor and ensure proper glycaemic control in diabetics patients (8). The A1C (HBA1c) test is carried out to measure the mean glycated haemoglobin level throughout the previous three-month period; the higher the percentage, the higher the blood glucose level, on average. If the HbA1c level is ≥7.0%, the American Diabetes Association (ADA) has categorized it as poor diabetes control where consequence of it are diabetes-related complications including macrovascular (coronary heart disease, peripheral vascular disease and cerebrovascular disease) and microvascular complications (retinopathy, nephropathy, and neuropathy) (9).

Health literacy (HL) pertains to an individual's capacity to make informed decisions based on the availability, understanding, and comprehending health information and services that are accessible (10). There are three levels of health literacy: functional, interactive, and critical. Functional health literacy includes basic skills like writing, reading and understanding the information received. Interactive health literacy includes being able to take part in health-related activities and empower themselves to apply their knowledge. Critical health literacy includes having the social and cognitive skills to think critically about information in order to make

decisions and have more control over own health and well-being (11).

Inadequate HL is associated with a poor understanding of the disease, low acceptance of treatment, poor adherence to self-care practices, difficulty making informed health decisions, and limited use of healthcare services (12, 13). HL is the best predictor of diabetes self-care and glycaemic control (14-17). Individuals with type 2 *diabetes mellitus* (T2DM), those with high HL, are better able to adopt and adapt to living with the disease and have good diabetes self-care practices and glycaemic control than those with low HL (18, 19). By determining the health literacy needed to influence self-care and glycaemic control, methods to enhance health literacy among T2DM patients can be developed, modified, improved, and strengthened. This knowledge will eventually allow healthcare personnel to manage each patient individually and improve their capacity to self-manage the disease through appropriate health promotion or education. Towards that end, this review assesses the most recent studies on the effect of HL on T2DM patients' self-care behaviours and glycaemic control.

METHODS

Eligibility criteria

This study has included all encompassed observational studies that measured association between health literacy and diabetes self-care behaviours and glycaemic control. Studies that were not in English or Malay, as well as conferences, reports, reviews, descriptive studies, protocols, research utilising clinical/pharmacological measurements, and studies that did not have the entire text available were excluded. To select eligible publications, the Preferred Reporting Item for Systematic Review and Meta-analysis (PRISMA) flow diagram was applied (Figure 1).

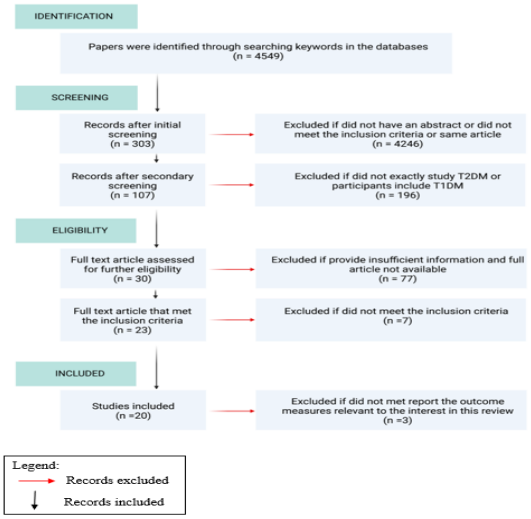

Figure 1: Prisma flowchart of the identified studies.

Data sources and search strategy

The literature search was conducted in Web of Science (WOS), Scopus, Google Scholar and PubMed. The following keywords, including relevant terms along with Boolean operators, were used to find relevant articles in these databases; "Health Literacy" AND "Diabetes" OR "Type 2 *Diabetes Mellitus* (T2DM)" AND "Diabetes Self-Care" OR "Diabetes Self-Management" OR "Glycaemic Control" in the title, abstract, or keywords were used to effectively search relevant studies. Keywords and specifications used in each database are stated in Table I.

Table I: Search string strategy.

Data	Search string
Scopus	TITLE-ABS-KEY (("health literacy") AND ("diab*tes self*care" OR "glyc*emic control" OR "diabetes self management")) AND (LIMIT-TO (EXACTKEYWORD , "Human") OR LIMIT-TO (EXACTKEYWORD , "Humans") OR LIMIT-TO (EXACTKEYWORD , "Adult") OR LIMIT-TO (EXACTKEYWORD , "Diabetes Mellitus, Type 2") OR LIMIT-TO (EXACTKEYWORD , "Self Care") OR LIMIT-TO (EXACTKEYWORD , ""Type 2 Diabetes Mellitus"))
Web Of Science	ALL= (("health literacy") AND ("diabetes self-care" OR " diabetes self-management") AND ("glycaemic control" AND "diabetes" OR "Type 2 Diabetes Mellitus (T2DM)"))
Google Scholar	AllinTitle: (("health literacy") AND ("diabetes" OR "Type 2 Diabetes Mellitus(T2DM)") AND ("glycaemic control" OR "diabetes self-care" OR "diabetes self-management"))
PubMed	(("health literacy"[Title/Abstract]) AND ("glycaemic control"[Title/Abstract] OR "diabetes selfcare"[Title/Abstract] OR "diabetes self-management")

Study selection

Publications published in English or Malay between 2018 and 2023 were evaluated. The selected studies were those that met the following inclusion criteria: (1) observational and quantitative studies; (2) involve adults with T2DM; (3) measured HL outcomes towards diabetes self-care behaviour includes diet, physical activity, self-monitoring of blood glucose, medication adherence and/or glycaemic control (HbA1c level); (4) complete analysis with bivariate analysis as the minimum statistical analysis used and the highest order statistical analysis will be used as the final findings; (5) validated questionnaire as a tool; (6) peer-reviewed article and (7) available of full article. Exclusion criteria are; (1) pregnant; (2) studies focusing on pharmacotherapy; (3) studies focusing on psychiatric disorders, physical disabilities, cognitive disabilities, medical comorbidities or diabetes-related complications; and (4) reviews or intervention studies.

Data extraction

Writers conducted data extraction independently and subsequently evaluated the extracted data to verify accuracy. The articles have been summarised in Table II, which include information such as the authors' names,

study design, sample size, objective, setting, country, tools used in measuring health literacy and diabetes self-care behaviours and statistical analysis result for diabetes self-care components and glycaemic control. The writers initially extracted data from a standardised table of evidence.

Table II: Summary of selected research articles.

Authors	Design	Sample size	Objectives	Setting	Country	Intervention tools	Outcomes					
							Diet	Physical activity	SMBG	Foot care	Medication	HbA1c
[18]	Cross-sectional study	347	To explore the potential association of HL with T2DM self-management and clinical outcomes	Rural and urban GP and PHC	Iran	BRIEF, DDSMB (diabetes self-management)	p < 0.001 (DDSMB)					p < 0.001
[33]	Cross-sectional study	448 patients with noninsulin-treated type 2 diabetes	To measure the association between HL and both patient-reported and clinical outcomes in patients with non–insulin-treated type 2 diabetes	Patients attended one of 15 University of North Carolina Health Care– associated primary care practices (family and internal medicine)	North Carolina	The Newest Vital Sign (NVS) screening tool	x	x	p = 0.001	x	x	p = 0.016
[30]	Cross-sectional study	204	To evaluate the functional HL of patients with T2DM and its impact on glycaemic control.	Hospital (specialist outpatient care)	Lahore, Pakistan	S-TOFHLA	x	x	x	x	x	p= 0.001
[37]	Cross-sectional study	300	To determine the relationship of HL and its subscales related to self-care behaviours, glycemic control (HbA1c) with self-care behaviours	Hospital university	Iran	Functional Communicative and Critical Health Literacy Scale (FCCHL); Summary of Diabetes Self-Care Activities (SDSCA)			p<0.001			p=0.47
[23]	Cross-sectional study	815	To evaluate HL and determine if adequate HL was independently associated with the health outcomes (good self-rated health, glycemic control and hospitalizations)	2 FMS clinics	Mexico	European Health Literacy questionnaire (HLS-EU-Q47); Diabetes self-care	p= 0.977	p< 0.001	x	x	p= 0.699	p=0.021
[27]	Cross-sectional study	200	To assess the relationship between functional HL and glycemic control of diabetic patients among the urban population.	Hospital university	Dhaka, Bangladesh	S-TOFLA, DKQ-10) and blood analysis report (HbA1c)	x	x	x	x	x	p<0.001

CONTINUE

Table II: Summary of selected research articles. (CONT.)

Authors	Design	Sample size	Objectives	Setting	Country	Intervention tools	Outcomes					
							Diet	Physical activity	SMBG	Foot care	Medication	HbA1c
[25]	Cross-sectional study	255	To explore the determinants of HbA1c levels in insulin-treated patients with T2DM, self-reported regimen-adherence factors, and psychosocial factors	2 OPD endocrine clinic	Taiwan	Health Literacy Scale for Diabetes; Self-reported regimen adherence factors; a 13-item Chinese version of the Diabetes Empowerment Process Scale; Short-Form Problem Areas in Diabetes scale (diabetes distress); 4-item scale measuring self-efficacy for insulin injection	x	x	x	x	x	p> 0.05
[31]	Cross-sectional study	249	To determine the relationship of HL among adult Saudis with T2DM patients and glycemic control.	Diabetes Clinic of the Endocrine Center at King Fahad Medical City	Saudi Arabia	Short Test of Functional Health Literacy in Adults (S-TOFHLA)	x	x	x	x	x	p> 0.05
[34]	Cross-sectional study	400	To investigate the relationship between HL and self-care behaviours	Private and public diabetes clinic	Iran	Summary of Self-Care Behaviors Activity Questionnaire; Health Literacy for Iranian Adults (HELIA)			p<0.05			x
[35]	Cross-sectional study	404	To determine the link between diabetes self-care behaviours, knowledge, HL	Healthcare centre	Iran	Health Literacy for Iranian Adults questionnaire (HELIA); diabetes knowledge; self-care behaviour; Summary of Diabetes Self-Care Activities			p<0.001			x
[28]	Cross-sectional study	329	To determine the association of HL and nutritional status assessments with glycemic control	Endocrine clinic	Iraq	S-TOFHLA	x	x	x	x	x	p< 0.001
[24]	Cross-sectional study	388	To examine the association between HL and general health, diabetes outcomes, health behaviours and empowerment in people with T2DM	Norwegian Prescription Database	Norway	HLS-Q12; health behaviours; Diabetes Empowerment Scale	x	p= 0.997	x	x	x	p= 0.319

CONTINUE

Table II: Summary of selected research articles. (CONT.)

Authors	Design	Sample size	Objectives	Setting	Country	Intervention tools	Outcomes					
							Diet	Physical activity	SMBG	Foot care	Medication	HbA1c
[32]	Cross-sectional study	344	To analyze and discover if an association exists between HL and glycaemic control	3 government healthcare	Klang, Malaysia	HL level (measured using The Newest Vital Sign-Malay (NVS-M) tool	x	x	x	x	x	p= 0.768
[26]	Cross-sectional study	102	To evaluate a novel composite measure of health literacy and numeracy by assessing its predictive validity for diabetes self-care activities and glycemic control	Family medicine clinic	Southeaster United States	Summary of Diabetes Self-Care Activities (SDSCA); (HLS)15 and numeracy (SNS)			p=0.04			p=0.04
[36]	Cross-sectional study	192	To examine the association of HL with self-care behaviours and glycemic control.	Health Centres of Sarab City	Iran	Assessing HL among Iranian adults (reading health information, ability to access health information and decision making); 12-item summary of diabetes self-care activities scale		p<0.05		x	p< 0.05	p= 0.001
[22]	Cross-sectional study	264	To examine the relationship between HL and diabetes self-care	Diabetes outpatient clinic of the university hospital	Istanbul, Turkey	Turkish version of the HLS-EU-Q (HLS-EU-Q-TR); Diabetes Self-Care Scale (DSCS)			p<0.001			p> 0.05
[29]	Cross-sectional study	356	To investigate the potential association between HL and other risk factors with glycemic control as measured by HbA1c	PHC	Kuwait	S-TOFHLA	x	x	x	x	x	p< 0.001
[19	Cross-sectional study	269	To examine the impact of HL on the health outcomes in T2DM patients.	3 PHC	Saudi	Brief Health Literacy Screening Tool (BRIEF)- 4 questions; Summary of Diabetes Self-Care Activities (SDSCA); World Health Organization Quality of Life (WHO-QOL)-BRIEF			p<0.001			p< 0.001
[20]	Secondary analysis of a prospective trial involving hospitalized patients with insulin-requiring T2DM	158	To evaluate the relationship between HL, social support, and self-efficacy as predictors of change in A1c and readmission among hospitalized patients	inpatient	Ohio, US	Newest Vital Sign (NVS); Multidimensional Scale of Perceived Social Support (PSS); Diabetes Empowerment Scale Short-Form (DES-SF)	x	x	x	x	x	p= 0.009

CONTINUE

Table II: Summary of selected research articles. (CONT.)

Authors	Design	Sample size	Objectives	Setting	Country	Intervention tools	Outcomes					
							Diet	Physical activity	SMBG	Foot care	Medication	HbA1c
[21]	Cross-sectional study	199	To determine if HL is a predictor of biochemical parameters and whether HL and its domains are predictors of specific self-care behaviours	From the participants' baseline assessments in a national project encouraging self-care for DM in primary health care.	Brazil	14-item health literacy scale (HLS-14); Brazilian version of the Diabetes Self-Care Activities Questionnaire	p= 0.002	p= 0.983	p= 0.838	p= 0.092	p= 0.027	p= 0.008

Data analysis

This review examined association between health literacy and diabetes self-care behaviour; consist of diet, physical activity, SMBG, foot care and medication and glycaemic control (HbA1c) by extracting statistical measure of the p-value.

Summarising and reporting the results

The scoping review approach was selected because it is exploratory in nature. The primary objective of a scoping review is to offer a comprehensive summary of the existing knowledge on the subject issue. The study design, methodologies, and main outcomes were summarised and reported. The text discusses the effect of health literacy in T2DM patients' diabetes self-care behaviours and glycaemic control. It also highlights the research gap that has been identified.

RESULT

Overview of studies

A total of 4549 articles were first identified by conducting a search using key search phrases in the four databases. Thirty full-text publications were evaluated for eligibility after being scanned twice. Twenty of them met the inclusion criteria (Fig 1).

All selected studies were observational (Table 2). Nineteen studies were cross-sectional; only one was a prospective study (20). The study population consisted of adult people with T2DM who follow up under primary health care centres or outpatient clinics, and one study focused on to be discharged inpatients (20). Types of questionnaires used by researchers to assess health literacy level were the Brief Health Literacy Screening Tool (BRIEF) (18) and (19), Health Literacy Scale (HLS) (21-26), Short Test of Functional Health Literacy in Adults (S-TOFHLA) (27-31), Newest Vital Sign (NVS) (20, 32, 33), Health Literacy for Iranian Adults questionnaire (HELIA) by (34, 35) and (36) and Functional Communicative and Critical Health Literacy scale (FCCHL)(37). The most commonly used type of questionnaire was Health Literacy Scale (HLS).

The primary outcome measures several diabetes self-care behaviours, including healthy diets, physical activities, medication adherence, foot care, self-monitoring blood glucose (SMBG), and glycaemic control. Six studies measure diabetes self-care behaviour and glycaemic control, two studies measure outcomes on all diabetes self-care behaviours, and twelve studies measure outcomes on glycaemic control.

Description and analysis of outcomes

The impact of HL on glycaemic control was inconclusive. This is because twelve out of twenties studies demonstrated that HL were associated with a great improvement in glycaemic control, while the other six showed no difference (22, 24, 25, 31, 32, 37). The variation in HL findings could be attributed to the utilization of different study instruments.

Seven studies demonstrate that HL were associated with all five diabetes self-care behaviours (19, 22, 26, 34, 35, 37, 38). However, other studies investigated HL's relationship with selected diabetes self-care behaviour, such as low HL was a factor of unhealthy diet practices and less medication care (21), significant association HL with physical activity (23), SMBG (33) and significant association HL with diet, medication adherence, SMBG, and physical activity (36).

DISCUSSION

This brief review summarises current studies about the impact of HL on diabetes self-care behaviour and glycaemic control via observational studies conducted worldwide. In the setting of instruction for patients with chronic illnesses like diabetes, HL has been presented as a measurable and essential term. There are many types of HL questionnaires and all of questionnaires used were validated and recognized worldwide, which makes it hard to compare health literacy levels across nations. The identified instruments possess inherent strengths and weaknesses due to their structure, characteristics, and measuring scope. These limitations have restricted the accuracy and consistency of the impact of health literacy on improving diabetes self-care behaviours and glycaemic control. The continuous advancement of instruments indicates that there is still a requirement

for thorough measurement across various populations. Therefore, it is imperative for researchers to prioritize the development of more extensive and dependable tools for measuring health literacy. These tools will aid healthcare practitioners in identifying individuals with T2DM who have insufficient health literacy in a more efficient and accurate manner.

According to a scoping review of instruments used to assess HL in T2DM patients (38), the choice of questionnaires used depends on the health literacy domain, and FCCHL and BRIEF offer the broadest measurement scopes. They are rapid, simple, and economical to administer. The BRIEF has demonstrated its usefulness as a practical tool for evaluating the level of functional health literacy in populations diagnosed with T2DM. The device provides a diverse array of measures, demonstrates robust measuring qualities, and possesses multiple advantages compared to other instruments. The FCCHL scale evaluates the broader concept of health literacy, which includes the abilities to access, understand, and apply health-related information. However, only two studies used BRIEF (18, 19) and one study used FCCHL (37) to assess HL levels and their effectiveness.

Diabetes patients need lifelong medical care, lifestyle changes, and self-care practices in aiming for good glycaemic control benefits in preventing, reducing, or delaying complications and having an optimized quality of life (39). The risk of problems associated with diabetes will be decreased by maintaining good glycaemic control. High HbA1c levels (≥8%) are associated with a higher stroke rate and increased risk for mortality and morbidity of cardiovascular disease (40) thus worsened the condition in a patient with a longer duration of diabetes. Maintaining an HbA1c level <7.0% for 5 years may reduce the odds of developing diabetes-related complications includes ischaemic heart disease, nephropathy, metabolic disorder, nephropathy, and peripheral vascular disease (41).

Generally, diabetes care is self-managed by the patient, so self-care is important. Research suggests that HL is a key factor in determining the level of self-care and good glycaemic control and is consistent with a previous total of 61 studies using meta-analysis involving nearly 19,000 T2DM patients (14). Findings from other studies also show that adequate HL helps with good self-care practices and glycaemic control (15-17). Besides that, a meta-analysis on intervention programmes utilizing HL and behaviour-based education to improve diabetes self-care done in developed countries (United States, China, Brazil, Mexico, Iran, Taiwan, Germany, Thailand, Canada, England and Japan) also resulted in better self-care and lower HbA1c levels (42).

The socioeconomic status and level of education of individuals vary according to the income levels of their respective countries (43), which in turn influences their HL perspectives and consequently impacts their engagement in diabetes self-care behaviours and glycaemic control. It is because high-income countries often have better healthcare infrastructure, providing more educational resources and support systems (44) for individuals with higher HL, further facilitating effective diabetes management. In contrast, in low and middle-income countries, even with good HL, external factors like limited healthcare access and resources (45) might still impede effective diabetes management, complicating the relationship between HL and HbA1c. However, in this review, the significance of glycaemic control is questionable as six other studies from both middle and high income countries show that HbA1c has a negative relationship with HL (22, 24, 25, 31, 32, 37) but act as a mediator between self-care and HbA1c (37). Other than that, multivariate analysis revealed that health literacy was not the main factor even though bivariate analysis gives significant value of an association between HL with latest HbA1c (25). Therefore, to control or minimize the confounding effect of socioeconomic and level of education factors, researchers may employ diverse methodological techniques either during the study design phase (e.g., randomised trials and longitudinal studies) (46) or during the analysis phase (e.g., statistical adjustments and stratified analysis) (47). These strategies collectively facilitate a deeper understanding of how HL, socioeconomic status, level of education, and glycaemic control intersect in improving diabetes management.

LIMITATIONS

This review has several limitations. Firstly, cross-sectional studies are unable to establish causation in predicting connections due to their inherent nature. Secondly, the self-administered questionnaire used may lead to biased results, thus limiting the studies' generalizability. Lastly, the questionnaire types reviewed differ and may lead to inconsistent results.

CONCLUSION

This scoping review shows a significant relationship between HL and diabetes self-care behaviours (physical activity, healthy diet, SMBG, medication adherence, and foot care) among T2DM patients. However, HL association with glycaemic control is inconclusive. Given the significance HL has in diabetes self-care behaviours, more research is needed to clarify and draw conclusions about the importance of HL in glycaemic control.

Most importantly, this analysis implies that an individual's HL level is necessary to absorb health information and guidance from healthcare experts, act on it, and seek appropriate treatment at healthcare facilities. On the other hand, illiterate people are less likely to use preventative services, have less

understanding of diseases, self-care practises, or health management, and are more likely to be hospitalized and require emergency services, all of which result in poor health outcomes (13). This conclusion emphasizes the need to assess and enhance individuals' health literacy levels and treat their ailments. This information will also enable healthcare professionals to handle each patient individually and increase their patients' ability to self-manage the disease through proper health promotion or education.

ACKNOWLEDGEMENT

We extend our gratitude to those individuals who also took part in our research. Gratitude is also extended to the Faculty of Medicine, National University of Malaysia for their unwavering assistance in ensuring the accomplishment of this written work.

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