

Correlation Between Functional Health Literacy and Self-efficacy in People with Type 2 Diabetes Mellitus: Cross-sectional Study

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Abstract

To analyze the correlation between functional health literacy (FHL) and self-efficacy (SE) in people with type 2 Diabetes Mellitus. Cross-sectional study was conducted among September and October 2019, with 196 people with type 2 diabetes. Data were collected using the *Functional Literacy in Health instrument* (B-TOFHLA) and the *Diabetes Management Self-Efficacy Scale for Patients with Type 2 Diabetes Mellitus* (DMSES). Bivariate analysis was used to verify the relationship among the constructs. Most diabetics showed an average B-TOFHLA score of 74.75, considered adequate, and self-efficacy of 4.07, high. The association between SE and FHL in the bivariate analysis found no statistical significance ($p > .05$), in the same sense as the B-TOFHLA score and the DMSES domains ($p > .05$). Constructs were not related to each other in terms of skills arising from judgments and decisions with motivational confidence by the investigated audience.

Keywords

self-efficacy, functional literacy, diabetes mellitus Type 2, disease management, self-care, nursing

Introduction

Diabetes Mellitus is a chronic disease with high incidence and prevalence in the world and is directly related to population aging, inappropriate habits, and lifestyles (Chatterjee et al., 2017). Worldwide, it is a disease on the rise, and projections show that for the year 2035, about 592 million people will develop the disease, characterized by a pandemic that is difficult to control (International Diabetes Federation [IDF], 2019). Thus, the therapeutic and non-pharmacological approaches, as physical activity and healthy diet, are essential for maintaining health and minimizing acute and chronic complications.

The maintenance of health and minimization of acute and chronic complications require abilities and motivation that support health education strategies with a focus on promoting healthy behaviors for people with Type 2 Diabetes

Mellitus (T2DM), helping to improve self-care management in various activities, such as diet, physical exercise, blood glucose monitoring, and medication adherence (Lee et al., 2019; Marques et al., 2019).

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Evidence shows that self-efficacy (SE) contributes to a better knowledge of diabetes, as well as facilitating behavior change and glycemic control (Quiñones et al., 2014; Selçuk-Tosun & Zincir, 2019); it increases the capacity for self-management in various activities, such as diet, physical exercise, blood glucose monitoring, and medication adherence, which are fundamental activities to maintain control, and decrease acute and chronic complications (Gao et al., 2013).

Self-efficacy is defined as an individual's confidence in the ability to motivate themselves to successfully achieve a specific objective in a given context, understood as a cognitive variable, with motivational function, based on the judgment that people make about their own abilities (D'Souza et al., 2017; Selçuk-Tosun & Zincir, 2019). This term comes from Albert Bandura's Social Cognitive Theory, which emphasizes the idea that much of learning and human behavior depends on interaction with the social environment in people's development.

Considering the theoretical assumptions of Social Cognitive Theory, four mechanisms are necessary to promote it, which include performance achievements (direct experiences), vicarious experience, verbal persuasion, and psychological and emotional states. From this perspective, SE in patients with diabetes can influence behavioral change and performance in self-care. So, people develop this capacity, through the different experiences that can be presented throughout life, and bring knowledge, as well as the acquisition of new skills (Bandura, 2004).

About this, factors such as empowerment about diabetes, the support network, the years lived with the disease, the participation of health education groups, and beliefs related to SE can improve the management of the disease. A justification for this is that SE may be related to the patient's choices to do or not to do something, linked to motivation, perseverance, and weaknesses to stress and depression, during treatment. The literature shows that, the stronger the beliefs about SE in the management of chronic diseases, the better the results of symptoms and quality of life (Quiñones et al., 2014; Selçuk-Tosun & Zincir, 2019).

However, for this to be achieved, it is necessary that patients know the risks and benefits involved in this process so that there is a change in attitude. This can be stimulated through Functional Health Literacy (FHL) (Bandura, 2004). The FHL is an emerging field within the area of health promotion defined as the ability to obtain, process and understand basic information and services in order to make appropriate decisions regarding health and medical care (Santos & Portella, 2016). The term "literacy in health" (*literacy health*) was first treated in 1974 by Simonds, and only in 1999 was reworked by the American Medical Association (AMA) as "Functional Literacy in Health," recognizing it as a set of skills that include reading, understanding and acting on health information (Simonds, 1974).

This is related to the ability to empower oneself through a broad set of cognitive, interactive, and enumerative skills

essential for navigation and understanding of the disease within a health system (Wolf et al., 2014). Among these skills are the ability to read and understand written texts, locate and interpret information in documents, as well as write or fill in (functional) forms, in addition to the ability to effectively communicate and listen to health-related (interactive) information; to use the internet as a research tool to obtain health information and make the appropriate (critical) decision; thus using numerical information for tasks, such as interpreting drug dosages, food labels and blood glucose measurements (numbering); and certainly, the ability to know how to apply them to improve health status (Al Sayah et al., 2013; Squellati, 2010).

Thus, SE and FHL can be understood as skills that together would enhance healthy judgments and decisions, aimed at maintaining and promoting the health of people T2DM. In the literature, it is possible to identify studies using both in international settings (Abreu et al., 2018; Fransen et al., 2012; Quiñones et al., 2014; Selçuk-Tosun & Zincir, 2019). However, there are gaps regarding the association of FHL and SE as well as the influences of these variables involved in maintaining the health of T2DM, which may favor the planning of strategies to improve glycemic control and the maintenance of the conducts necessary for a healthy lifestyle.

Therefore, the guiding question emerged: There is an association between FHL and SE in patients with T2DM? Thus, the aim of the study is to analyze the relationship between FHL and SE in people with T2DM over 35 years old in northeastern Brazil.

Methods

This is a cross-sectional, analytical, and correlational study developed in a secondary care center for people with T2DM and hypertension in Fortaleza, northeastern Brazil, from September to October 2019. The study followed the STROBE's recommendations.

The sample size was defined using the finite population formula of Yandell (1997) considering a 95% confidence level (1.96), 80% power (0.84), and a correlation coefficient of 0.20 (Magalhães & Lima, 2007; Rahmi et al., 2017), resulting in 196 people to compose the sample.

Patients were selected aleatory, according to the inclusion criteria: people over the age of 35, of both genders, registered at the health care center for at least 6 months, and with literacy instruction-level minimum who has completed the fifth year of elementary school. The choice of this age group is justified due to the fact that, in Brazil, the highest prevalence of patients with diabetes are between 35 and 69 years (Brazil, 2019). The exclusion criteria were having difficulties that make communication impossible to answer the instrument, such as hearing or speech impairment.

Each participant was recruited in the waiting room by the researchers, who informed about the purpose and invited

people to be part of the study. Every participant agreed, voluntarily consenting to the signing of the Free and Informed Consent Form. It should be noted that a pilot study was carried out with 22 individuals (not included in the study sample), in order to identify problems in understanding the research and making the necessary adjustments to the instruments to guarantee the quality of data collection.

To measure FHL, the test of functional health literacy in adults-simplified (B-TOFHLA) validated for the Portuguese was used (Maragno et al., 2019). To be clear about the B-TOFHLA, the first stage consists of a text with medical instructions (such as information about the exam, guidance on fasting, and contact with the hospital) in order to assess the understanding of health information. This text presents 36 spaces that must be completed by the correct option among the four multiple-choice alternatives provided. Each hit adds two points to the score, totaling 72 points. This subtest is timed for 7 minutes without the respondent being communicated, being interrupted only if the time is exceeded (Baker et al., 1999). Then, the numbering step is applied, in which four cards are shown to assess the ability to calculate the time of medication after 6 hours, the recognition of the normality of a glycemic rate given the reference values, date of the next appointment, and calculation of the time of a fasting medication. For each hit in this stage, seven points are added to the total. Thus, by adding the points of the two stages, the total FHL score is obtained, which reaches the maximum value of 100 points. Depending on the score obtained, it can be classified as inadequate (0–53 points), marginal (54–66 points), or adequate (67–100 points) (Selçuk-Tosun & Zincir, 2019).

The second instrument was the *Diabetes Management Self-Efficacy Scale for Patients with Type 2 Diabetes Mellitus* (DMSES) with 20 items, divided into four domains: Specific Nutrition and Weight, Physical Exercise, Blood Glucose, and General Nutrition and Medical Treatment. These domains refer to three types of activities: essential activities for the treatment of diabetes, self-observation activities, and self-regulation activities (Van der Bijl et al., 1999). The final score is determined by the global average of the scale, that is, the score assigned to each item is added and divided by the number of items. Higher averages indicate a greater perception of self-efficacy (Van der Bijl et al., 1999).

To reduce bias, the STROBE recommendations were used. Thus, we decided not to include patients deaf or losing hearing and with no cognitive ability to answer the questionnaire.

The data were stored in the *Microsoft Excel spreadsheet* and analyzed using the STATA 11.2 software. Bivariate analysis was used to verify the relationship between the domains of the Self-Efficacy Scale (DMSES) and the B-TOFHLA (Functional Literacy in Health) instrument. For this, first, linear correlation tests and comparison of averages between groups were used. However, due to the absence of normal distribution of the variables, it was

chosen, in the numerical variables between two groups, to use the Mann-Whitney test. Among three or more groups, we use the Kruskal-Wallis test. To analyze the correlation among numerical variables, Spearman's correlation coefficient was used for non-parametric samples. The level of significance adopted in the statistical tests was $p < .05$.

This project was conducted in accordance with the Declaration of Helsinki and approved to the Ethical Committee of the Universidade Federal do Ceará (approval number: 18396719.0.0000.5064).

Results

The sample includes 196 people with T2DM, 52% (102) female with a mean age of 57 years old ($SD=8.39$). Most of the participants ($n=112$, 57.14%) were white; 66.30% (130) had less than 9 years of study; 56.63% (111) were married or had a long-term relationship; 73.9% (145) live with an average monthly income of 1 to 2 minimum wages and 64.8% (127) were Catholic.

Among them, 57.14% do not use the internet and 93.50% do not participate in any support groups. The mean time of diagnosis for diabetes was 13.66 years, with a time in the treatment of 13.27 years. The main treatment was the oral hypoglycemic drugs associated with insulin (44.90%). The majority of the participants followed a restricted diet (78.06%), exercises (52.55%), and had other comorbidities (82.14%). Regarding the clinical results of the management of the chronic condition, it was observed that the majority of the participants had elevated levels of glycemia (94.38%), were overweight/obese (79.59%), and pre-hypertensive (45.40%).

FHL was categorized as adequate in 57.14% (112) of the participants while 23.47% (46) was on the limit, and 19.39% (38) was considered inadequate. The mean of the total literacy score was 74.75 ($SD=16.35$). The reading comprehension of the participants had a mean of 57.95 ($SD=12.08$ /CI 95%: 56.2–59.6), and in numerical functional literacy, a mean of 16.75 ($SD=6.51$ / CI 95%: 15.8–17.6), using B-TOFHLA.

In this study, the internal consistency of the instruments assessed using Cronbach's alpha was 0.70 for reading comprehension items, 0.94 for numbering items, and overall, 0.86 for B-TOFHLA. In the DMSES there was a value of 0.78.

Regarding the self-efficacy scale, 58.1% (114) showed high self-efficacy, and 41.8% (82) were classified as having medium self-efficacy. None of the participants showed low self-efficacy. In Table 1, it is possible to observe that the domains which obtained the best medians were "Blood glucose" and "General nutrition and medical treatment."

When comparing the total scores of FHL and SE, was observed that the higher the functional literacy, the higher the self-efficacy ($r=0.059$, $p=.412$). Although these data do not demonstrate statistical significance, it is possible to observe a positive trend (Figure 1).

Table 1. Distribution of Measures of Central Tendency in the Domains of the Self-Efficacy Scale (DMSES). Fortaleza, CE, Brazil, 2019.

Self-efficacy scale	Min–Max	Mean (SD)
Specific nutrition and weight	1.0–5.0	3.5 (0.98)
Physical exercise	1.75–5.0	4.5 (0.83)
Blood glucose	2.33–5.0	4.5 (0.56)
General nutrition and medical treatment	1.66–5.0	4.46 (0.64)
Total	2.55–5.0	4.07 (0.56)

As for the association between SE and FHL in the bivariate analysis, there was no statistical significance ($p > .05$), in the same sense as the score of the B-TOFHLA, in a continuous (numerical) way, observing the absence of association statistically ($p > .05$), between the domains of the DMSES instrument and the B-TOFHLA (Table 2). Regarding the bivariate analysis among the diabetes self-efficacy scale (DMSES), and the categories of the B-TOFHLA, it also did not show statistical significance ($p > .05$), once more, between the FHL and SE.

However, there is no statistically significant correlation between the DMSES score and the FHL levels (B-TOFHLA) (Figure 2). Those with adequate and minimal literacy had a higher average (82 points and 85 points), in comparison with the inadequate level (79) (Figure 2).

Discussion

About the FHL, the participants who used B-TOFHLA obtained 74.75 points ($SD = 16.35$), and 57.14% obtained an adequate level of literacy. These findings differ from other studies in the national literature, in which an average of 56 points was found in the B-TOFHLA, and 65.9% of the patients had inadequate FHL associated with low education (<9 years of study). These differences can possibly be attributed to the inclusion criteria about the educational level, which was more than 9 years in the present study for the majority of the participants (66.3%), and less than 8 years of schooling in another one developed in Brazil (Sampaio et al., 2015). In this respect, this study shows, in a theoretical-practical way, that SE is not a personal determining condition for FHL.

However, it is important to continuously evaluate both to successfully achieve the goals applied in the treatment, since these can promote behavioral changes in people with chronic health conditions.

Corroborating with the data, another study that evaluated the level of FHL in people with diabetes, on an ambulatorial at a university hospital, showed that 73.3% of the patients had a good level of FHL through the B-TOFHLA, and that most of the population had more than 9 years of study (Castro et al., 2014).

A study that analyzed a straight relationship between FHL and low level of education (<9 years), which shows a statistical significance between the increase in years of schooling and higher performance on the B-TOFHLA test, found that 51.3% of the participants had bad FHL score, and just 32.1% good result (De Rocha et al., 2019). In this study, the FHL in individuals considered to be literate was assessed, this fact may have interfered in this analysis.

Evidence reveals that when people with T2DM have a good FHL score, it can result in looking for a support network and being able to face less food and medication barriers. Being young-adult, they have greater knowledge about the disease and greater communication with health professionals (Bains & Edege, 2011).

FHL barriers are successfully overcome using new and didactic methods, such as audiovisual, games, and other experimental methods (Caruso et al., 2018; Kim & Lee, 2016). However, people with low education or inadequate FHL can be especially vulnerable to deficits in understanding and effectively applying educational materials. These technologies most often introduce a lot of information, present complex concepts, and use language for individuals with higher literacy (Kim & Lee, 2016). However, people with diabetes who have a low level of literacy and do not have adequate FHL at the same time, may not be fully understanding health education.

In this sense, FHL has been worked to be acquired and improved in people with DM, through the use and support of theories, programs, and technologies that facilitate the acquisition of skills among people with the disease. A study carried out in Taiwan, with the purpose of observing the acquisition of the ability of FHL in people with DM and the change of behavior, using the trans-theoretical model to understand how the relationship between FHL and glycemic control is, highlighted that FHL is acquired when patients are aware of its importance in coping with the disease and with blood glucose control (Tseng et al., 2017).

A 12-month diabetes education program has significantly improved FHL by showing that this modality can raise awareness and change results in people with inadequate FHL, in addition to increasing the effects of those who already had adequate FHL (Swavely et al., 2014). Likewise, a study with multimedia technology focused on diabetes education helped in the acquisition and increasing of FHL among people with the referred chronic condition (Hahn et al., 2015).

The variables investigated in the DMSES pointed to four types of essential activities for the treatment of the disease, such as the use of medication, diet follow-up, physical exercise and medical monitoring, with a view to investigating people's motivating and trusting behavior and how they are feeling with the care activities that they must perform for the management of the disease. It was observed, in this study, that the total average obtained in DMSES (SE) was high, with a higher score in the domains of physical exercise and

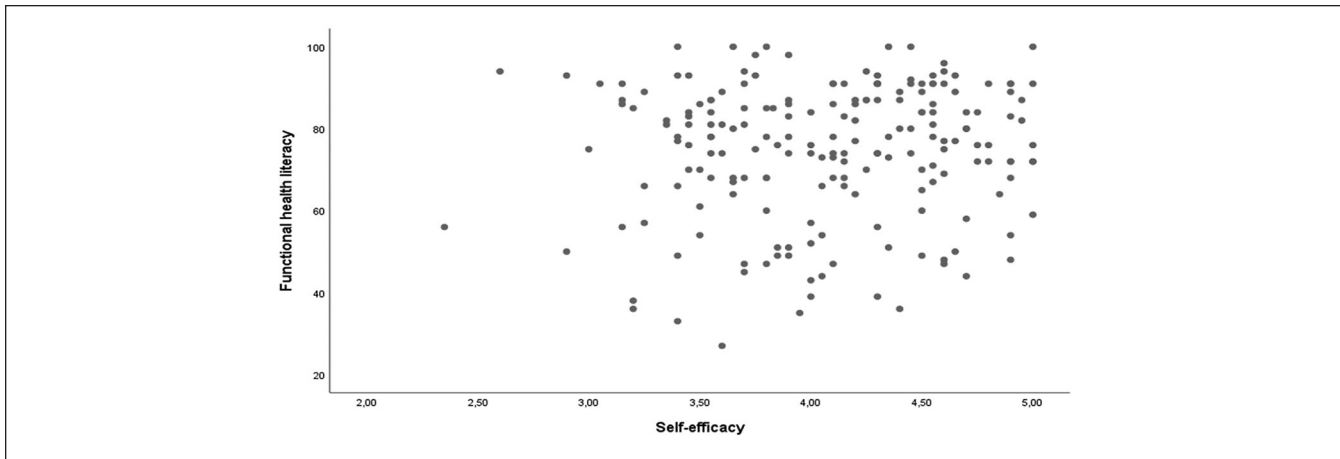


Figure 1. Correlation among scores of functional literacy and self-efficacy. Fortaleza, CE, Brazil, 2019.

Table 2. Bivariate Analysis between the Classification and Punctuation of the B-TOFHLA Instrument by the DMSES (SE) Domains in People with T2DM. Fortaleza, CE, Brazil, 2019.

Variables	Specific nutrition and weight		Physical exercise		Blood glucose		General nutrition and medical treatment		Total score	
	Mean (SD)	<i>p</i>	Mean (SD)	<i>p</i>	Mean (SD)	<i>p</i>	Mean (SD)	<i>p</i>	Mean (SD)	<i>p</i>
Inadequate	3.28 (1.12)	.11	4.17 (0.91)	.58	4.36 (0.62)	.55	4.45 (0.70)	.15	3.96 (0.63)	.40
Minimal	3.76 (0.90)		4.33 (0.83)		4.34 (0.66)		4.59 (0.53)		4.17 (0.47)	
Adequate	3.47 (0.95)		4.22 (0.80)		4.48 (0.50)		4.41 (0.65)		4.06 (0.56)	
	<i>R</i> ²	<i>p</i>	<i>R</i> ²	<i>p</i>	<i>R</i> ²	<i>p</i>	<i>R</i> ²	<i>p</i>	<i>R</i> ²	<i>p</i>
FHL score	0.008	.90	0.01	.82	0.05	.41	-0.11	.10	0.02	.74

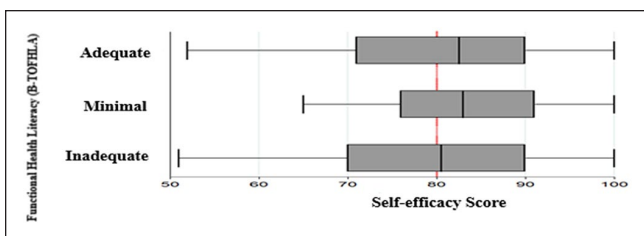


Figure 2. DMSES self-efficacy score distribution, according to functional literacy in health levels (B-TOFHLA). Fortaleza, CE, Brazil, 2019.

blood glucose, and lowest average in the field of specific nutrition and weight.

Divergent results from this study were evidenced in the literature, in which the participants obtained a total mean of the scale of 3.66 (mean LA), with the highest score in domain IV (general nutrition and medical treatment), and the lowest score in domain III (blood glucose) (Tharek et al., 2018). Likewise, another study found that the mean was 2.41, obtaining the highest mean in domain III (blood glucose) (Reisi et al., 2016).

When observing the findings, it was perceived more directly that, for people with T2DM, it is a challenge to adapt

to the new lifestyle, mainly with the motivation and confidence in acquiring new eating habits and resisting the consumption of unhealthy foods. Thus, it can be inferred that participants who have lower SE in terms of specific nutrition and countless weight deal with issues that can interfere in the adherence to a specific diet for diabetes, such as financial difficulties, insatiable desire to eat sweet foods, pleasure in eating, easy access to high carbohydrate foods. In this way, people with high scores in SE get motivation with the presented situation and maintenance of enthusiasm, even when the situation seems to be fixed in a complicated stage of treatment (Coelho et al., 2017).

The theoretical references of SE and FHL allow to observe the process of development and acquisition of both, individually, in people with T2DM. Different repercussions were also observed, which may be under the presence/absence of both concepts in the disease. Studies show that the FHL acts as a skill in what the SE refers to a belief that has, as an outcome, also a personal performance ability, hence they seem to be interconnected and acting almost similarly in the care and control of diabetes (Quiñones et al., 2014; Selçuk-Tosun & Zincir, 2019).

As for the verification of the association between the level of FHL and the level of SE, it was found that there was no

association in any of the analysis performed (bivariate by domains and scores)—SE ($p = .40$) and FHL ($p = .72$), coinciding with the findings of another study, in which there was also no association between SE and FHL ($r = 0.13$; $p \geq .05$), using the same analysis (Huang et al., 2018).

On the other hand, a study carried out in Switzerland identified a significant trend among the SE scores, which increased along with the increase in the FHL levels (Zuercher et al., 2017). It is noteworthy that, in this study, were used other instruments, such as the *Brief Questions to Identify Patients with Inadequate Health Literacy* and the *Stanford Self-Efficacy Questionnaire*, scales that measure self-efficacy in chronic diseases, but not specific for assessing SE in T2DM. Furthermore, the approach of the participants was through telephone call, employing a single question to evaluate the FHL in health.

The instruments used and the approach adopted by the referred study cover measurement and appear to be indirect in contact with people, thus, it is considered the greater specificity in the assessment of SE in T2DM with the use of DMSES, since this instrument directly highlights the disease and its care. Also, the B-TOFHLA test is more comprehensive in measurement (reading comprehension and numerical part), compared to the score of the direct questions made in the calls.

Particularly, some studies have found that FHL is directly linked to self-care behaviors in diabetes, through SE (Kav et al., 2017; Lee et al., 2016) and social support (Osborn & Egede, 2010; Rashid et al., 2018). While others did not detect this association (Eyüboğlu & Schulz, 2016; Tseng et al., 2017).

A systematic review study, which sought to assess the relationship between FHL and SE in individuals with diabetes, showed that the particularity of the type of literacy directly influences self-efficacy (Xu et al., 2018). The study concluded that the communicative and critical subdimensions were related to the individuals' motivation. Three studies showed results similar to those found in this study, in which FHL was not related to SE (Al Sayah et al., 2015; Inoue et al., 2013; McCleary-Jones, 2011; White et al., 2013).

Despite not being the object of investigation here, the synthesis of the evidence from Xu et al., (2018) shows that factors affect the FHL and SE. Thus, five factors (educational level, professional status, annual income, marital status, and Internet use) were positively associated with FHL. On the other hand, three factors (age, years of life with diabetes, and depressive symptoms) showed a negative association. Another seven factors (age, years of life with diabetes, professional status, social support, diabetes education, clarity of the doctor's explanation, and absence of diabetic complications) were associated with SE. Therefore, this evidence points to challenges that need to be further investigated, in particular how three factors (employment status, social support, and clarity of the doctor's explanation) can be related to

FHL and SE, and how depressive symptoms can demonstrate negative relationships with both.

Additionally, due to the absence of statistical correlation, possibly due to SE, which presents itself in an abstract and relative way, arising from the idea of achieving results through personal motivation, it leads to having specific or general behavior that, at the same time, cannot be measured objectively, but the challenges and impediments to carrying out the task can be measured. In relation to the FHL, it is a skill that guides behaviors through judgments and decisions, in a more conscious way, and can be measured in a more concrete way. Therefore, the FHL almost directly influences the presence of SE in people with T2DM.

Study Limitations

There are limitations in the sample analyzed once the participants were all literate with more than 5 years of study and just from a single diabetes specialized center, located in the urban area of a Brazilian capital. Thus, further studies are suggested, with people with T2DM from other institutions and with different levels of education and from both locations, whether urban or rural, in order to identify the level of self-efficacy and functional literacy in this population group. So, the results of this study should be observed with caution, with regard to the generalization of findings to other social and regional contexts. Also, it is noteworthy that this study did not intent to analyze other levels of health literacy such as the communicative/interactive and criticism that may be related to self-efficacy, as well as the use of tools that involve filling in self-reports such as DMSES.

Relevance to Clinical Practice

The evidence shows the need to direct attention and efforts to disseminate information and practical knowledge easy to understand, especially because the FHL is linked to the level of education presented. Also, the study shows the importance of increasing strategies focused on the diet and the adoption of new life habits to achieve better control and adherence to the treatment of diabetes, a fact that can help in the judgment and decisions regarding the management of diabetes and quality promotion of self-care. Likewise, it is necessary that nurses make continuous reevaluations of the FHL level on the guidelines offered, focusing on diabetes education programs, and avoiding clinical inertia.

The results sign the importance of nurses involved in health education using the easy-to-understand language for people with diabetes to understand health information. It empowers the individual to be able to obtain, process, and understand information about his/her health status or make a correct decision about the long-term care needed to control diabetes. Thus, it is important to continuously assess functional health literacy and the motivational capacity to successfully achieve the goals applied in treatment. These

strategies are important for behavioral changes in people with chronic health conditions since there are several factors that contribute to the adherence to pharmacological and non-pharmacological treatment of diabetes.

Assessment of self-efficacy in relation to the treatment of diabetes is also relevant for appropriate interventions to be targeted at people who do not feel confident in maintaining the daily care that favors glycemic control and, consequently, a better quality of life.

Conclusion

The present study has revealed adequate FHL, and elevated SE was found in people with T2DM. Regarding the relationship between the FHL and the SE, there is no correlation among the classification of the FHL and the domains of the SE, FHL scores, and SE domains, as well as SE scores and FHL classification when a specific instrument was used for this chronic condition. Thereby, constructs were not related to each other in terms of skills arising from judgments and decisions with motivational confidence by the investigated audience.

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