Causal Relationship Model of Health Literacy, Self-Efficacy Perception, Self-Care Behaviors on Blood Sugar Levels Among Elderly People with Type-2 Diabetes

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KEYWORDS	ABSTRACT
Health Literacy, Self-Efficacy perception, Self-Care behavior, blood sugar level, elderly.	Objective: To develop a causal relationship model of health literacy, self-efficacy perception, and Self-Care Behaviors on Blood Sugar Levels of Type 2 Diabetes on Elderly and check for the developed model's consistency with empirical data. Method: The sample consisted of 455 elderly people with type-2 diabetes who could not control their glycemic control using stratified sampling. The tool used to collect data was a questionnaire. The confidence value was 0.804-0.964. The LISREL program analyzed structural equation model data. Results: The developed causal relationship model consisted of self-care behaviors as direct negative causes of blood sugar levels. Health literacy and self-efficacy were negative indirect causes of blood sugar levels with self-care behavior as a carrier. The developed model was consistent with the empirical data with Chi-Square = 62.20, *df*= 54, *relative Chi-Square* = 1.15, *p* = 0.20733, *RMSEA* = 0.0183, RMR= 0.00895, S*RMR* = 0.0186, G*FI* = 0.983, *AGFI* = 0.962, *CFI* = 0.999, *NFI* = 0.989 and all variables contributed to the percentage variance in blood glucose level. at 97.8 %. Conclusion: The findings revealed that in caring for the elderly with type 2 diabetes, health literacy development must be considered, self-efficacy perception and better self-care behavior in order to help reduce blood sugar levels in this group of elderly people in the end.

1. Introduction

The prevalence of diabetes is an increasing problem worldwide due to a lifestyle and life expectancy. Diabetes in the elderly is becoming a serious public health problem (1). Thailand is one of the developing countries which is experiencing this problem. According to the report on the prevalence of people diagnosed by a doctor in Thailand between the years 2015 and 2018, the prevalence increased from the age group 45-54 years, 55-64 years to the highest In the age range of 65-74 years, when the age group gets older, there will be a higher tendency of disease (2) and in 2019, 18.79 percent of the elderly were diagnosed with diabetes and were able to control their sugar levels according to the standard of only 29.13 percent, which the indicators set by Thailand's Ministry of Public Health have not yet been achieved at 40% or more (3) There are complexities in many dimensions, including physical, mental, social and economic conditions. This can lead to Geriatric syndrome, a non-specific health problem. It is a complex condition and is often caused by multiple pathologies (4). If the patient is unable to control the blood sugar level and there are more than 2 complications, it may result in a decrease in quality of life (5). that occur during the life of the elderly chronic health problems and illnesses Including a group that lacks the opportunity to receive news, access to social welfare and health services due to deterioration in physical health mind and society, make the concept of health literacy more interesting because it is an important concept and indicator to affect health behaviors and health outcomes (6).

Health literacy is the cognitive processes and social skills that enable individuals to become motivated and able to access, understand, and use information to promote and maintain their own good health (7), which the health literacy component developed according to the concept of Don Nutbeam (8) of the Division of Health Education (9) mentions 6 key fundamental characteristics, namely Access, Cognitive, Communication, Decision skill, Self-management, and Media literacy are directly related to an individual's ability to become self-reliant and maintain their health. From the literature review, it was found that Health knowledge of the Thai elderly Present intelligence was insufficient, low to fair (10,11,12), and health literacy was positively associated with self-management (13). In type 2 diabetes mellitus, it was found that most of the patients had a fair level of knowledge and might be able to do some things correctly (14). It was shown that patients with adequate health literacy were 2.03 times better at controlling their blood glucose levels compared to those with insufficient health literacy. and found that the likelihood of kidney and vascular complications was 2.33 times and 2.71 times,

respectively (15). Some studies also found that health literacy was positively associated with self-care behavior and blood sugar control in patients with type 2 diabetes (16,17). Increased health literacy will help change self-care behaviors as well as resulting in decreased blood sugar levels (18) blood glucose levels (19,20), while some studies also found that health literacy directly influenced self-efficacy (21,22).

In addition to the concept of health knowledge, it was also found that the Bandura self-awareness concept (23) was consistent with the findings of the study. Self-efficacy was correlated with self-care behavior and blood sugar control (21,24,25,26), with higher cognitive performance being associated with lower cumulative blood glucose levels (27), some studies suggesting that subcomponents of cognitive performance in terms of eating, physical activity, drug use, and self-care behaviors were associated with blood sugar levels (25,28). With type 2 diabetes mellitus (21,22,24,29), Orem's concept of self-care behavior (30) was consistent with the results of the study showing that self-care behavior had a positive correlation with control blood sugar level to meet the standard. This reduces complications and improves the quality of life of patients (31). The results of previous studies also found important components of self-care behavior that can predict good health outcomes, including diet, exercise, medication and stress management. The aforementioned behavior affects blood sugar control in diabetic patients in the next order. (31,32,33,34) Self-care behaviors were also found to have a direct negative influence on blood sugar levels (19,20,21), based on a review of theoretical concepts and relevant studies. This led the researcher to speculate that self-care behaviors might be a contributor for health literacy and self-efficacy to blood sugar levels. However, there is still no clear link between health literacy, one's performance, self-care behaviors and blood sugar levels in uncontrollable type-2 diabetic elderly. This is a group that has a high chance of complications in the future. Therefore, it is important to study the linkage in order to use the results of the study to determine further solutions to the problem.

From the prevalence of diabetes in the elderly the occurrence of complications that may cause disability and life threatening coupled with the inconsistency in conclusions about the link between health literacy one's performance Self-Care Behaviors and Blood Sugar Levels in Uncontrollable Type 2 Diabetic Elderly In the past, only the study of the relationship between the above variables was found. The researcher therefore needs to study a causal relationship model on blood glucose levels by developing a model based on health knowledge. It was the primary variable that directly influenced self-efficacy perception and self-care behavior. Self-efficacy perception directly influenced self-care behavior and self-care behaviors had a direct influence on blood sugar levels in the next order. Health literacy and self-efficacy had a negative indirect effect on blood sugar levels. The self-care behavior variable was a direct factor that had a negative direct influence on blood sugar levels. The structural equation model was analyzed with the LISREL program. The results of the analysis could be used as data for determining the method model. or ways to promote and support knowledge in health self-efficacy perception and self-care behaviors that are suitable for this group of elderly people.

Research Objectives

1. To develop a causal relationship model of health literacy, self-efficacy perception, Self-Care Behaviors on blood sugar levels in Type-2 diabetic elderly.

2. To examine the consistency of the causal relationship model of health literacy, self-efficacy perception, Self-Care Behaviors on blood sugar levels of Type-2 diabetic elderly with empirical Data.

Conceptual Framework

This causal relationship model aimed to develop the model and verify the model's consistency with empirical data. The researcher used the theoretical concepts and results of reviewing research papers related to influential relationships between variables to summarize the conceptual framework of the research which consisted of the concept of health literacy components of the Division of Health Education (9), consisting of 6 components: Access, Cognitive, Communication, Decision skill, Self-

management and Media literacy. Self-efficacy consisted of 3 components: Perceived self-efficacy in food control exercise, medication (25,28), and self-care theory, there are 4 components: eating behavior exercise taking medicine stress management (31,32,33,34). There are 2 components of blood glucose levels: FBS and HbA1C which can be summarized as Figure 1.
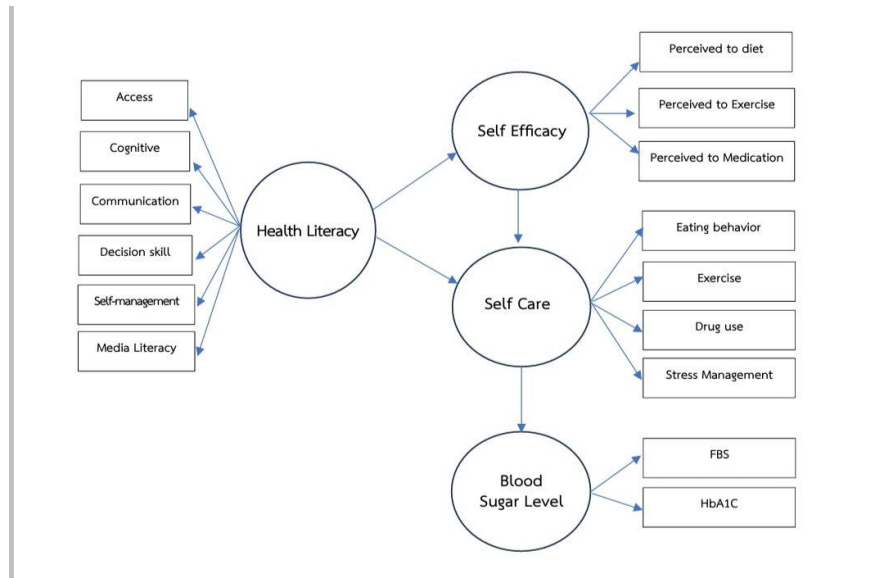

Figure 1: The causal relationship model of health literacy, self-efficacy perception

Self-Care Behaviors on Blood Sugar Levels in Type-2 Diabetes Elderly

Research Hypothesis

1. The causal relationship model of health literacy self-efficacy perception Self-care behaviors on blood sugar levels of type 2 diabetes mellitus elderly were consistent with empirical data.

2. Health literacy has a negative indirect effect on blood sugar levels with the self-care behavior variable as a carrier.

3. Self-efficacy has a negative indirect influence on blood sugar levels with the self-care behavior variable as a carrier.

4. Self-care behaviors have a negative direct influence on blood sugar levels.

2. Methodology

Study Design and Sample

This is a Cross-Sectional Analytic Study using elderly people aged 60 years and over with uncontrolled type 2 diabetes mellitus as sample groups. The sample size was determined using the program G*Power (35), the medium effect size was set to .03, the value Alpha = .05, the Power = .80, and the variable degrees of freedom (df) was set to 82 to reserve and prevent the error not exceeding 10%. A total of 455 samples were obtained using Stratified Random, sampling classified by type of medical facility, then randomly sampled using Simple random sampling according to population proportion. A specified number of samples were obtained from Communication hospitals, Sub-district Health Promoting Hospital, and 33 Communication health centers. They were elderly patients with type-2 diabetes, receiving treatment for at least 5 years, being treated with medication and being able to communicate.

Measurements

Health literacy developed from a health literacy measuring tool according to the principle for Thai people at risk of diabetes and high blood pressure (36) together with a health literacy measuring tool for the elderly (37) consisting of 6 components: Access, Cognitive, Communication, Decision skills, Self-management, and Media literacy, a total of 27 items, question types are on a Rating scale with 5

levels: most, most, medium, least, least. S-CVI = 1.0 and reliability Cronbach alpha coefficient is 0.907.

Self-efficacy perception Developed from the Diabetes Management Self-Efficacy Scale (DMSES) (38) Thai Version of the Diabetes Management Self-Efficacy Scale: T-DMSES (25) and the self-efficacy scale (39) consisting of food self-efficacy, self-efficacy in exercise, self-efficacy on drug use, 15 items, the question type is a rating scale with 5 levels, namely, the highest, the most, the moderate, the least, the least. S-CVI = 0.87 and the reliability. The Cronbach alpha coefficient is 0.964.

Self-Care Behavior in Controlling Blood Sugar Levels Developed from the Summary of Diabetes Self-Care Activities Measure: SDSCA (40) English Version of the Summary of Diabetes Self-Care Activities Measure: T-DSMS (25) and the Self-Care Behavior Measurement Tool for type 2 diabetes patients (41) consisting of eating, taking medicine, exercise, and stress management of 15 items. The questionnaire is a frequency of self-care activities in a week. Criteria for determining the frequency of activities in a week (1 = did not practice at all, 2 = performed 1-2 days, 3 = performed 3 days, 4 = performed 4-5 days, 5 = performed 6-7 days). CVI = 1.00 and Confidence Cronbach alpha coefficient is 0.894.

The blood glucose level consists of Fasting Blood Sugar (FBS) and Accumulated Blood Sugar (HbA1C). Using Best's grading criteria (42), fasting blood sugar (1 = 130-155 mg/dl, 2 = 156-180 mg/dl, 3 = 181-205 mg/dl, 4 = 205-230 mg/dl) and criteria for determining the cumulative blood sugar (HbA1C) (1 = 7.01-7.50 %, 2 = 7.51-8.00 %, 3 = 8.01-8.50 %, 4 = 8.51–9.00 %). S-CVI = 1.00 and Cronbach's alpha coefficient confidence value was 0.804.

Data Collection

Data collection took place after reviewing research ethics from the Human Research Ethics Committee Burapha University (IRB3-037/2566), which the sample group who is willing to provide information, and acknowledgment of research objectives. The rights of the research participants have been clarified. Agreement to cooperate in providing information and Informed consent process Data collection by interview and record the laboratory blood test results from the patient's medical record.

Statistical analysis

General data were analyzed by descriptive statistics, only number, percentage, mean, and standard deviation, and the causal relationship model of health literacy, self-efficacy perception, Self-care behaviors and blood glucose levels of type-2 diabetes mellitus elderly were developed against empirical data by using structural equation model using LISREL program (Version 10.10 Student) with the following consideration criteria: The model concordance indices are relative $\chi2 < 2$ or P value > .05. The concordance indices GFI, AGFI, CFI, NFI must be greater than .95 and RMSEA, RMR and SRMR must be less than. 05 The weight of each element must be greater than 0 at the .05 level of statistical significance using a t-test, absolute value of t must be greater than 1.96 (43,44).

3. Result and Discussion

General Information of Respondents

The sample group were elderly people with type-2 diabetes, mostly 316 females, 69.50%, and 139 males, 30.50%. The sample group had an average age of 68.74 5.73 years. 322 people were married, 70.76%, followed by single status, 84 people, 18.46%; Primary school graduation 126 people, 27.69 %; most of them are Buddhists of 358 people, 78.68 %, followed by Muslims of 86 people, 18.90 %; Most of the samples have an income of less than 5,000 baht, 140 people, 30.77%, followed by an income range of 5,000-9,999 baht, 112 people, 24.62%, on average, with an illness duration of about 9.91$\pm$ 4.19 years.

Average Value of Variables

For Health Literacy, the findings were Access with an average of 2.63 $\pm$ 0.71; Cognitive with an

average of 2.66 ± 0.72; Communication with an average of 2.76 ± 0.73; Decision skill with an average of 2.77 ± 0.74; Self-management with an average of 2.88 ± 0.79; and Media literacy with an average of 2.85 ± 0.69

Self-efficacy, the findings were food self-efficacy with an average of 2.97 ± 0.66; self-efficacy in exercise with an average of 3.11 ± 0.76; and self-efficacy on drug use with an average of 3.18 ± 0.79.

Self-Care Behavior, the findings were eating with an average of 3.11 ± 0.58; exercise with an average of 3.26 ± 0.58; taking medicine with an average of 3.17 ± 0.57; and stress management with an average of 3.25 ± 0.66.

The blood glucose level consists of Fasting Blood Sugar (FBS) with an average of 175.78 ± 25.25 mg/dl; Accumulated Blood Sugar (HbA1C) with an average of 7.86 ± 0.534 %

Structural Equation Model

First-order confirmatory factor analysis to test the consistency of each component in the model, the model consistency index criterion (43,44) was used, as well as the Average Variance Extraction: AVE and Composite Reliability: CR were used. The criterion was AVE > .05 and CR > .70. The model validation index was obtained as follows: Chi-Square = 76.24, df= 60, relative Chi-Square = 1.270, p = 0.07690, RMSEA = 0.024, RMR= 0.0115, SRMR = 0.0229, GFI = 0.979, AGFI = 0.958., CFI = 0.997, NFI = 0.987 where the consistency index meets the specified criteria. The analysis also found that the Average variance extraction: AVE was between 0.621-0.875 and Composite reliability: CR was between 0.868 - 0.933. All components passed the specified criteria AVE > .05 and CR > .70, thus indicating that the studied components in the model are consistent. It was found that the values were in the range of 0.777 – 0.968. The weights of all observed variables were significantly different from zero at the .05 level, indicating that all 15 observed variables were important indicators of all 4 components.

The results of checking the consistency of the causal relationship model of Health literacy, Self-efficacy perception, Self-Care Behaviors on Blood Sugar Levels of Type-2 Diabetic Elderly with empirical data by using the model consistency index criterion (43,44). Details are shown in Table 1, 2 and Figure 2.

Table 1: Correlation coefficients among latent variables in the causal relationship model of health literacy, self-efficacy perception, Self-Care Behaviors on Blood Sugar Levels in Type-2 Diabetic Elderly

Variables	Health Literacy		Self-Efficacy		Self-Care		Blood Sugar Levels	
Health Literacy	1.000							
Self-Efficacy	0.748		1.000					
Self-Care	0.855		0.782		1.000			
Blood Sugar Levels	-0.845		-0.773		-0.989		1.000	
Constant Variable	Y1 0.829	Y2 0.789	Y3 0.820	Y4 0.494	Y5 0.494	Y6 0.496	Y7 0.518	Y8 0.902	Y9 0.968
Constant Variable	X1 0.790	X2 0.802	X3 0.833	X4 0.788	X5 0.840	X6 0.848			

*X1= access, X2 = cognitive, X3= Communication, X4= decision skill, X5= self-management, X6= media literacy,Y1= Perceived to diet, Y2= Perceived to exercise, Y3= Perceived to medication,Y4= Eating behavior, Y5= Exercise, Y6= Drug use, Y7= Stress management , Y8= FBS ,Y9=HbA1C
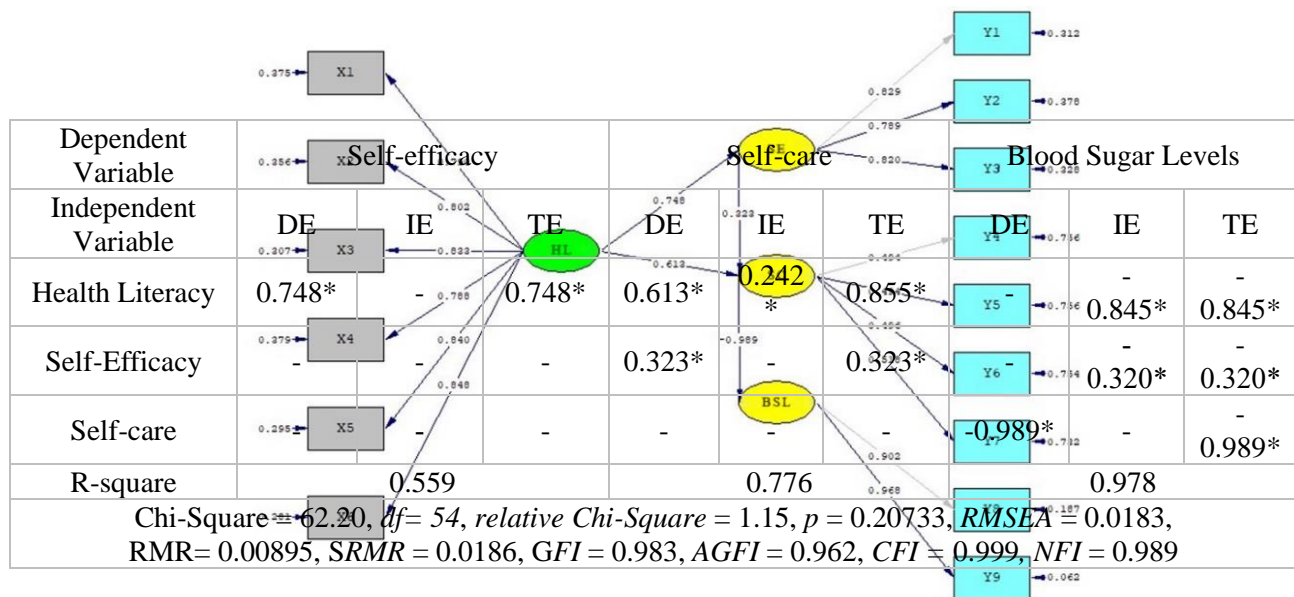
From Table 1, it was found that latent variables health literacy, self-efficacy perception, Self-Care Behaviors on Blood Sugar Levels had a positive correlation between 0.748 and 0.855 and a negative correlation between -. 0.773 to – 0.989 and all 15 observed variables were Access (X1) Cognity (X2) Communication (X3) Decision Skill (X4) Self-Management (X5) Media Literacy (X6) Food Self-Efficacy (Y1) Self-Efficacy. in exercise (Y2) Self-Efficacy on drug use (Y3) Self-care behavior on

eating (Y4) Self-care on exercise (Y5) Self-care on taking medicine (Y6) Self-care on stress management (Y7) Fasting Blood Sugar (FBS) (Y8) Accumulated Blood Sugar (HbA1C) (Y9) had a reliability between 0.494 – 0.968, indicating that the developed model was suitable for analyzing latent variable pathways.

Table 2: The influence coefficients of the causal relationship model of health literacy, self-efficacy, Self-Care Behaviors on Blood Sugar Levels in Type-2 Diabetic Elderly

$*p < .05$

Figure 2: Standard weight of the causal relationship model of health literacy, self-efficacy, Self-Care Behaviors on Blood Sugar Levels in Type-2 Diabetic Elderly

Dependent Variable	Self-efficacy			Self-care			Blood Sugar Levels		
Independent Variable	DE	IE	TE	DE	IE	TE	DE	IE	TE
Health Literacy	0.748*	-	0.748*	0.613*	0.242*	0.855*	-	0.845*	0.845*
Self-Efficacy	-	-	-	0.323*	-	0.323*	-	0.320*	0.320*
Self-care	-	-	-	-	-	-	-0.989*	-	0.989*
R-square	0.559			0.776			0.978		
Chi-Square = 62.20, df= 54, relative Chi-Square = 1.15, p = 0.20733, RMSEA = 0.0183, RMR= 0.00895, SRMR = 0.0186, GFI = 0.983, AGFI = 0.962, CFI = 0.999, NFI = 0.989									

* Health literacy (HL), X1= access, X2 = cognitive, X3= Communication, X4= decision skill, X5= self-management, X6= media literacy, Self-efficacy (SE), Y1= Perceived to diet, Y2= Perceived to exercise, Y3= Perceived to medication, Self-care (SC), Y4= Eating behavior, Y5= Exercise, Y6= Drug use, Y7= Stress management, Blood sugar level (BSL), Y8= FBS, Y9=HbA1C

From Table 2 and Figure 2, it was found that the developed causal relationship model of health literacy, self-efficacy, Self-Care Behaviors on Blood Sugar Levels in Type-2 Diabetic Elderly was consistent with empirical data (Chi- Square = 62.20, df= 54, relative Chi-Square = 1.15, p = 0.20733, RMSEA = 0.0183, RMR= 0.00895, SRMR = 0.0186, GFI = 0.983, AGFI = 0.962, CFI = 0.999, NFI = 0.989). that Self-Care behavior had a negative direct influence on Blood Sugar Levels; Health literacy and Self-Efficacy had a negative indirect influence on Blood Sugar Levels with the Self-Care variable. behaviors

were the carrier, which variables Health literacy, Self-efficacy, Self-Care Behaviors could explain 97.8% of the variation in Blood Sugar Levels.

When considering the influence of the variables on the Blood Sugar Levels variable, it appears that Self-Care behavior had the highest influence on Blood Sugar Levels, followed by Health Literacy and Self-Efficacy. The overall effect size was -0.989, -0.845 and -0.320 respectively.

When considering the coefficient of influence of Self-Care Behavior, it was found that Self-Efficacy had a direct influence on Self-Care Behavior with a direct influence coefficient of 0.323, while Health Literacy had a direct and indirect influence on Self-Care Behavior with The Self-Efficacy variable is a carrier. There was a direct influence coefficient of 0.613 and an indirect influence coefficient of 0.242. When considering the influence coefficient of Self-Efficacy, it was found that Health Literacy had a direct influence on Self-Efficacy. has a coefficient of direct influence equal to 0.748

Discussion

The results of the health literacy causal relationship model, self-efficacy self-care behavior perception on blood sugar levels of the developed type-2 diabetes mellitus elderly are consistent with the empirical data. This is because the analysis results show that all consistency indices pass the specified criteria. Parameter values differ from zero on all lines. The magnitude and direction are consistent with the established theory (43,44), suggesting that self-care Behavior has a negative direct effect on blood sugar levels, Health Literacy and Self-Efficacy have a negative indirect effect on blood sugar levels with a variable Self-Care Behavior is the carrier. However, when considering each variable that affects blood sugar levels as follows:

Health Literacy was the primary variable that had a positive direct influence on Self-Efficacy perception. However, when considering the weight of the indicators sorted by Health Literacy from the most is Media Literacy, Self-Management, Communication, Access, and Decision Skills can explain that this group of elderly are elderly who have experience about illness and treatment of diabetes for about 9.91 ± 4.19 years, making them quite competent about diabetes. Media Literacy can validate reliability of health information, make a plan for correcting or managing yourself when you get sick. Skills in communicating about illnesses, have a basic understanding of diabetes able to access health information search channels, can consider the balance of good results disadvantages between the ability to carry out behavioral goals and their actual ability to make appropriate behavioral modification decisions. When the elderly has Health Literacy, they will gain more confidence in their own performance, make believe that they have the ability to successfully perform the goal behavior. Health Literacy has a direct influence and an overall influence on Self-Efficacy equal to 0.748, which is consistent with the results of the study that found that Health Literacy has a positive direct influence on self-efficacy with an effect size of 0.41 (29). Literacy also has a positive direct and indirect influence on self-care behavior with the variable Self-Efficacy being a carrier. It can be explained that elderly people with type-2 diabetes with health literacy will have media literacy, self-management skills, able to communicate, have knowledge and understanding of information, can evaluate and make appropriate decisions including having confidence in their own ability to meet the goals set; therefore, leading to the adjustment of Self-Care Behavior suitable better which can be seen that Health Literacy influences self-care behavior. The size of the direct effect was 0.613, the indirect effect was 0.242, and the overall effect was 0.855, consistent with the results of the study that found that Health Literacy has a direct effect on Self-Care Behavior with an effect size of 0.567 (24), similar to the results of the study finding that Health Literacy, self-efficacy has a positive direct effect on self-care of the elderly with disabilities type-2 diabetes with effect sizes of 0.31 and 0.13, respectively (29). Literacy directly affects Self-Care Behavior and also indirectly affects Self-Care Behavior through self-efficacy (22). Self-care and blood sugar levels of the elderly with type-2 diabetes also found that Health Literacy has a negative indirect influence on blood sugar levels with a variable Self-Care Behavior is the passerby. This is because older people with Health Literacy can apply skills such as Media Literacy, Self-Management, Ability to communicate, knowledge, understanding, ability to access health information and services. The

ability to consider and make decisions for Self-Care Behavior, which Self-Care Behavior can affect blood sugar levels. If older people with type-2 diabetes are more literate, there will be Self-Care Behavior that much as well. This will lower the blood sugar level of the elderly. This is consistent with the results of the study that found that Health Literacy has a negative indirect effect on blood glucose (HbA1C) with a variable self-efficacy perception. and the Self-Care variable Behavior is the carrier (21).

The Self-Efficacy variable had a positive direct influence on self-care behavior. The results are consistent with Bandura's theory (24), which states that perceived self-efficacy determines decisions about one's ability to manage and leads to behavioral decisions to achieve goals. expect. Therefore, self-efficacy awareness is an important concept used in health behavior change, consistent with the results of the study that found that self-efficacy awareness has a positive direct effect on Self-Care Behavior with size. The effect was 0.191 (25) and the results indicated that perceived Self-Efficacy had a positive direct influence on Self-Care Behavior with an effect size of 0.65 (21). Negative indirect influence on blood sugar levels with a variable Self-Care Behavior is a transmissible, when considering in order of weight the Perceptual Self-Efficacy indicator the most. were perceived performance in food control, drug use and exercise, respectively, indicating that when this group of elderly people felt confident in their ability to control food Medication and Exercise Cause Self-Care Better Behavior as well gain confidence Confident to show self-care More accurate Behavior As a result, it can reduce blood sugar levels. It can help reduce the occurrence of complications and continue to have good health, which is consistent with the results of the study that found that the perception of self-efficacy has a negative indirect effect on blood sugar levels. with a variable Self-Care Behavior is the carrier (21).

Self-Care Behavior has a negative direct influence on blood sugar levels, which can be explained when a person develops a disease or illness. will cause a quest Recognize and adapt to create Self-Care. suitable Behavior for good health outcomes, in line with Orem's concept (30) and when considering the weight, the most abundant indicator was Self-Care Behavior in terms of stress management. exercise in terms of food intake and medication, respectively. For stress management behaviors, it can affect blood sugar levels. Because in normal conditions when stressed, the body will secrete more cortisol hormone, resulting in inhibition of insulin secretion. Stimulate glucagon secretion and increase blood sugar levels. Therefore, if the patient is able to manage stress, it can result in a decrease in blood sugar levels. In addition, exercise behavior plays an important role in helping control blood sugar levels. due to increased metabolism from food eaten It increases insulin performance, resulting in lowering blood sugar levels in diabetic patients. As for the behavior of eating food and proper medicine. It directly affects the reduction of the patient's blood sugar level to an appropriate level and prevents complications. Therefore, if the elderly has good Self-Care Behavior, it will affect blood sugar levels both Fasting Blood Sugar (FBS) and accumulated blood sugar (HbA1C) reduced. Behavior; therefore, it has a negative direct effect on blood sugar levels with an overall effect size of -0.989, consistent with the results of the study that found that Self-Care. Behavior had a negative direct effect on cumulative blood glucose (HbA1C) in type 2 diabetics with an overall effect size of −0.21 (p<.05) (21), similar to the results of the study. Self-care was found to have a negative direct effect on cumulative blood glucose (HbA1C), with an overall effect size of -0.19 (p<.05) (19).

4. Conclusion and future scope

The findings indicated a causal relationship between Health Literacy, Perceived Self-Efficacy, Self-Care Behavior, and blood glucose levels can be used to design methods or guidelines for caring for elderly people with type-2 diabetes who are unable to control their sugar levels to develop Health Literacy, Self-Efficacy awareness and Self-Care Behavior, which will ultimately help reduce blood sugar levels in this group of elderly people.

Research Implications

This research is beneficial for aging care and healthcare personnel in taking care of elderly persons who have type 2 diabetes for better heath. The research discovery that health literacy is important for health care personnel to design a comprehensive training program in elderly with type 2 diabetes program in dietary, physical workout and daily lifestyle. Moreover, it helps to develop self-warning and self-management for elderly persons to take care of themselves. In addition, it help in planning for cognitive, access and decision skills for elderly persons. This care plan will help to build confidence in elderly persons in managing themselves and also help new care takers to provide appropriate health care program.

Recommendations for applying the research results

The researcher has suggestions for personnel responsible for caring for the elderly with type 2 diabetes in applying the research results to develop Health Literacy, Self-Efficacy and Self-Care perception Behavior to control blood sugar levels. It is recommended to design 3 steps, consisting of 1. Health Literacy Development (Health Literacy) phase, focusing on the elderly to be born in media. Health Literacy (Develop the ability to examine and assess diabetes data) Self-Management (develop ability, planning method self-warning and Self-Management) Communication (develop knowledge communication techniques Preparing questions, using questions, evaluating questions) Cognitive (develop knowledge abilities and memory skills understanding of diabetes) Access (improving knowledge in finding information consider resources service contact channels) and Decision Skills (develop the ability to identify problems set choice Evaluate alternatives 2. The process of building confidence to change behavior (Self efficacy) is to encourage confidence in one's ability to control diet, medication and exercise. It focuses on patients expressing their concerns and expectations. Reflection between existing behaviors and concerns and expectations to create motivation for self-change. Learning to use the model (Modeling) and being persuaded to gain confidence in one's own abilities (Verbal persuasion). 3. Actions for good health outcomes (Self-care behavior) should focus on practice for good health outcomes by designing activities from stress management behavior assessment exercise food intake and medication Providing knowledge and advice to change the correct behavior focusing on activities helps to manage stress. exercise activities in the right way food selection activities and effective drug taking activities Then, follow up on behavior change. Guide and encourage patients.

Recommendations for further research

A causal relationship model should be studied. Future research may focus on other variables besides Health Literacy, Self-Efficacy and Self-Care perception, such as health beliefs social support

Conflicts of interest

The researchers have no conflict of interest.

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