Effect of Self-Care Educational Intervention Based on Orem's Self Care Theory on Self-Care Management and Fasting Blood Glucose among Patients with Type 2 Diabetes

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Abstract: **Diabetes is one of the most common chronic health problems with alarming rapid increase worldwide. It is associated with many serious complications and self-management is essential to prevent or delay such complication. Aim: Examine the effectiveness of self-care education intervention based on Orem Self Care theory on self-care management and level of fasting blood sugar among patients with type 2diabetes and determine the relationship between appraisal of diabetes and self-care management among patients with type 2 diabetes. Design: Quasi-experimental design. Subjects and setting: A purposive sample consisted of 110 patients with type 2 diabetes, attending the diabetes outpatient clinic in Menouf's General Hospital at Menouf City, Menoufia Governorate, Egypt. Tools: Structured interview questionnaire sheet that concerned with socio-demographic data and patient's clinical data. Appraisal of Diabetes Scale used to determine diabetic patient's self-appraisal of diabetes. Diabetes Knowledge Questionnaire that concerned with assessing of patients' knowledge about type2 diabetes. Diabetes Self-Management Questionnaire that was used to assess diabetes self-care management activities over the last eight weeks.**

Results: Most of patients with type 2 diabetes had no previous education about diabetes, 42.7% had diabetes related complications, 64.5% appraised their diabetes as stressful and harmful for their daily life. The majority of diabetics had unsatisfactory level of knowledge and about half had low self-care management. Diabetics with satisfactory level of knowledge were significantly increased from 25.5% to 84.5% after the educational intervention based on Orem Self Care theory and increased the level of good self-management as well. The educational intervention resulted in significant control of the mean fasting blood sugar from 171 mg/dL ± 42.52 to 131 mg/dL ±27.37. Negative appraisal of diabetes associated with decreased diabetes self-care management.

Conclusion: The implemented educational intervention based on Orem Self Care theory has significant effects in improving on self-care management, diabetes related knowledge and reducing level of fasting blood sugar among patients with type 2diabetes. Patient's appraisal of diabetes affects their self-care management. Accordingly, designing and implementing Orem-based self-care management program can be used for improving self-care management of patients with type 2diabetes and thereby improving the disease outcomes.

Keywords: **Orem Self Care theory, Self-care management, Type 2 diabetes, Appraisal of diabetes, Fasting blood glucose.**

1. INTRODUCTION

Diabetes Mellitus (DM) is one the most common chronic metabolic disease in the world [1,2]. The prevalence of DM has reached the epidemic levels [3] and increasing in alarming rate especially in developing countries [4]. The worldwide prevalence of DM In 2011 was 8% according to the World Health Organization (WHO), and it is predicted to be 10% in 2030 [1, 5], this prevalence constitute 366 million individual with DM in 2011, and it is predicted to be it 552 million by 2030 [2]. In Egypt, DM is a rapidly growing health problem that has a significant effect on morbidity, mortality as well as health care resources [2]. Egypt is one of the world top 10 countries in the number of people with diabetes [2]. Recently, the prevalence of type 2 diabetes (T2DM) in Egypt is around 15.6% among the adults aged 20 to 79 [6]. Type 2 diabetes

is characterized by increased blood glucose levels that results from insufficient insulin and/or insulin resistance [7]. It constitutes 90% of all cases with diabetes; its incidence frequently increases due to lifestyle changes, decreased mobility and obesity [8].

DM is associated with many serious complications including renal failure, blindness, amputation, and cardiovascular disease [1, 5, 9, 10, 11]. Also, it is associated with increased morbidity, mortality, and health care cost. Individuals with diabetes at a higher risk of developing depression compared to general population [12] and have two to four times of increased risk for stroke [13]. DM is associated with reduction in life expectancy to one third [14] and high levels of distress [15]. DM related distress may results in reduced level of well-being, increased level of anxiety and depression [16], as well as decreased self-management activities [11].

According to American Diabetes Association, all individuals with DM should be provided with diabetes self-management education and support at the time of the diagnosis and subsequently as needed [17]. Self-care management for diabetes is the activities that taken by the affected people themselves for effective manage of the disease**.** Therefore, providing the patient with adequate knowledge about self-care is the mean entrance for achieving therapeutic goals [4]. Self-care behaviors for DM may include healthy eating, physically activity, monitoring of blood sugar, and compliance with medications, problem-solving skills, coping skills as well as risk-reduction behaviors [18, 19, 20]. Self-management of DM has important role in prevention of complications or delaying the progression of complications, faster recovery, and limits hospital staying and reduces re-hospitalization [21]. For these circumstances, the individuals with DM have to take much of the responsibilities for their daily care. Education is essential component of self-care empowerment because it can facilitate acquisition of knowledge and skills that enhance the individuals' abilities for self-care [17, 22]. However, self-management activities may dependent on how the individuals appraise their diagnosis of diabetes [23]. Individual's appraisal of illness is an important predictor of adherence to certain related behaviors including medical regimens of the illness [24]. DM can be appraised as threatening, harmful, or challenging. Individual's appraisal of diabetes as a challenging, instead of threatening or harmful, has been linked to improved self-care management [25].

Application of nursing theories and models are recommended for enhancing patients' self-care capabilities [26]. Orem self-care theory is one of the basic theories that provide good clinical guide for planning and implementing the principles of good self-care [27]. Self-care has been defined by Orem as the practice of activities that established and maintained by individuals themselves within specific time frames for the purpose of maintain life and well-being [28, 29]. According to Orem, human beings have the ability to take care of themselves, and the nurses have to help them when these abilities is being disturbed [30] because nurses' role considered as a facilitator and agent for change [31]. For these circumstances, Orem' self-care theory is used as a theoretical base for this study [32].
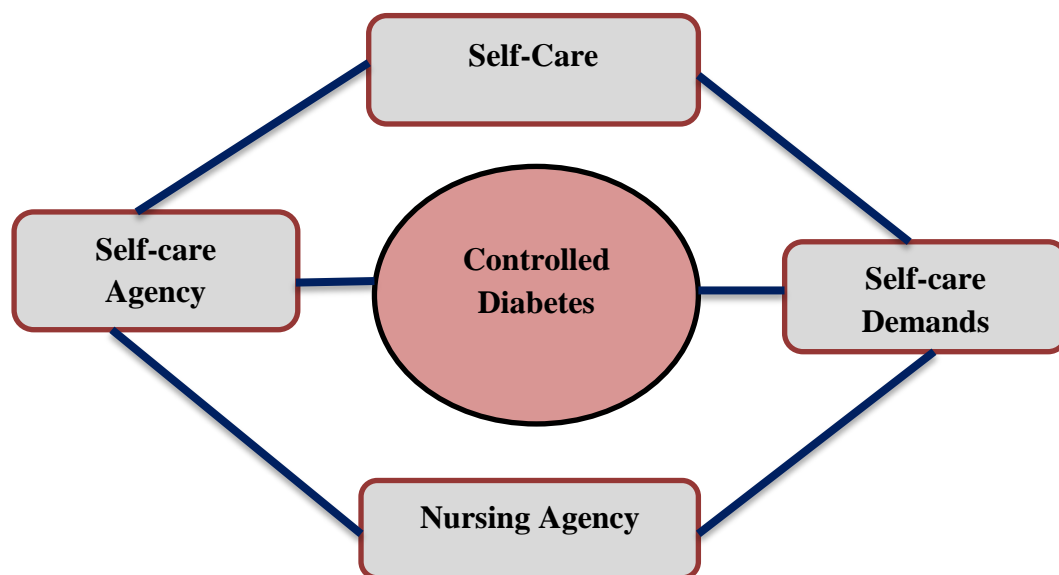

Figure 1: The diagram is designed based on the concepts of Orem's self-care theory

According to Orem, the basic concepts of self-care theory are self-care demands or requirements, nursing agency, self-care agency and self-care. Self-care demands are the total therapeutic self-care requirements and actions that should performed for duration of time to meet known self-care requisites using valid methods and actions [32]. Nursing agency is the educated and trained nurses who have the properties and attributes that enables them to respond effectively to help patients to meet their therapeutic self-care demands through enhancing their own self-care agency [33]. Self-care agency is the individual's capabilities to acquire disease self-care–related knowledge and skills. These capabilities involve self-testing, self-training, and self-learning [34]. Self-care is all the activities necessary to live and survive that performed by the patients themselves to alleviate symptoms and complications of diseases, shorten recovery, and reduce hospitalization [21, 35]. Hence, self-care education is of remarkable importance for diabetics and plays an essential role in the prevention of complication, and reduce re- hospitalization and enhancing self-confidence, [17] therefore, this study will conducted within the context of Orem's self-care theory to Examine the effectiveness of self-care education intervention on self-care management and level of fasting blood sugar among patients with T2DM and determine the relationship between appraisal of diabetes and self-care management among patients with T2DM.

1.1. Aim of the study:

1- Examine the effect of self-care education intervention based on Orem Self Care theory on self-care management, knowledge and fasting blood glucose among patients with T2DM.

2- Determine the relationship between appraisal of diabetes and self-care management among patients with T2DM.

1.2. Research hypotheses:

1. Patients with T2DM will have higher mean score of diabetes related knowledge in post-intervention compared to pre intervention.

2. Patients with T2DM will have higher mean score of self-care management behaviors after 12 weeks from diabetes self-care educational intervention based on Orem's Self Care theory compared to pre intervention.

3. Patients with T2DM will have lower level of fasting blood glucose after 12 weeks from diabetes self-care educational intervention compared to pre intervention.

1.3. Research questions:

1. How the patients with T2DM appraise their diagnosis with diabetes?

2. Is there a relationship between self-care management and appraisal of diabetes**?**

2. SUBJECTS AND METHODS

2.1. Research design:

Quasi-experimental research design with pre and post-test was utilized to achieve the aim of the study.

2.2. Study setting:

This study was conducted at outpatient clinic for diabetic patients in Menouf's General Hospital at Menouf City, Menoufia Governorate.

2.3. Subjects of the study: A purposive sample consisted of 110 patients with Patients with T2DM, attending the diabetes outpatient clinic in Menouf's General Hospital at Menouf City, Menoufia Governorate. The subjects of the study were chosen according to the following criteria: Age ≥ 30 years, two years at least from diagnosis time with T2DM, none severe complications related diabetes, none pregnancy, not having mental disorders or any form of handicapping. The sample size was estimated using Epi-info computer software program. The sample size was calculated, at a 95% confidence level, margin error 5% and a study power of 80%. The required sample size was 110.

2.4. Data Collection Tools: Five tools were used to collect the data for this study. These tools are described as the following:

Tool 1: Structured interview questionnaire sheet: It was developed by the researchers and concerned with: (a) Socio-demographic data: It was included questions about patient age, gender, marital status education level, occupation, income level and previous any form of diabetes education. (b) Patient's clinical data that included family history of diabetes, duration of diabetes, type of treatment and diabetes related complications.

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Tool 2: Appraisal of diabetes scale (ADS): It is a brief questionnaire that developed and tested for validity and reliability by Carey et al., 1991 [36]. It was comprised of seven item used for assessing diabetic patient's self-appraisal of his or her diabetes. Each item of the scale is rated on a 5-point Likert-scale with two items (2 and 6) are scored in reverse. The total score of scale items equal the sum of the scores for all items. The total score of the scale ranged from 7 to 35. The total score was categorized as ≤ 50% of the total score indicating positive appraisal of diabetes and >50% of the total score indicating negative appraisal of diabetes [36]. The Cronbach's alpha of the subscales ranged from .71 to .79 that indicated an acceptable level of internal consistency and reliability [3]**.**

Tool 3: Diabetes Knowledge Questionnaire (DKQ): It was developed by Menino, Dos, & Clarisse, 2017 [37]. The researchers used this Questionnaire for assessing of patients' knowledge about DM. It was consisted of twenty four questions concerning general patient knowledge about diabetes and its related issues including causes, risk factors, symptoms, complications, preventive measures and management of diabetes. The response to each item were three options and it was in the form of yes, no or don't know and each patient was asked to choose one of these three options. A key answer was determined according to the literature and DKQ was corrected by giving one score for correct answer and zero for incorrect and don't know answer. The knowledge score was calculated by summing the scores of all questions of the scale. The total knowledge score ranged between 0-24. The scoring system for diabetes knowledge was categorized as follow: ≤12 indicated unsatisfactory knowledge >12 indicated satisfactory knowledge. This tool was validated by Menino, dos and Clarisse, 2017 [37]; α coefficient was 0.86 that indicated good reliability of the tool

Tool 4: Diabetes Self-Management Questionnaire (DSMQ): Scale was designed by Schmitt et al., 2013 [38]. This scale was used to assess diabetes self-care management activities over the last eight weeks. It was composed of 16 items with seven of them are positively worded items directed and nine negatively reversing negatively worded items. The scale items was categorized into five subscales namely: dietary control (4 items), medication adherence (2 items), blood glucose monitoring (3 items), physical activity (3 items), health-care use (3 items) and the last item of the scale asked about rating of overall diabetes self-care which included in the 'Sum Scale' only. The response options of the sale were in four point Likert scale and the scores for each item ranged from 0-3 points; in which 3 point means the self-care item applies to me very much, 2 point means the self-care applies to me to a considerable degree, 1 point means the self-care item applies to me to some degree and 0 point means the self-care item does not apply to me. The score of DSMQ items was caculated after considering the negatively reversing worded items. The overall score of DSMQ was ranged from 0-48 and the degree of self-care management activities was categorized as follow: Poor diabetes self-management (from 0 to 15.9), moderate diabetes self-management (from 16 to 31.9) and good diabetes self-management (from 32 to 48). The DSMQ scales' α coefficients was 0.80 for the Sum Scale [38].

Tool 5: Measuring fasting blood glucose test: This test was carried out for each participant twice. The first time at the time of pre-intervention test and the second time was after 12 weeks. Fasting blood glucose test was carried out using GlucoSure STAR, a blood glucose monitoring system. Before testing, the participants asked for overnight fasting (eight hours), and then the test was carried out in the morning by the researchers. Aseptic technique was followed during the procedure. Blood glucose level of each participant was recorded and interpreted according to American Diabetes Association (ADA), as fasting blood sugar level in the range of 80 - 130 mg/dL, indicated controlled diabetes [39].

2.5. Validity of the study tools: The tools of study were translated into Arabic language by two English-Arabic specialists. Then the Arabic version was translated into English and any variation in the meaning was considered. The Arabic version of the tools were tested for content validity by a panel of three experts in community medicine and community health nursing and modifications were carried out according to the panel recommendations on clarity of the statements and appropriateness of the contents.

2.6. Pilot study: A Pilot study was carried out on a number of patients equal to 10% of study sample (11 patients with type 2 diabetes mellitus), to ensure clarity and applicability of the study tools and to find out any problems that might arise during the actual data collection. Based on the results of the pilot study, any needed modifications were done and the final form of the study tool was finalized and used for data collection. The sample of the pilot was not included in the total sample of the study.

2.7. Ethical considerations: The official permission to conduct the study was obtained by the researchers from the official authorities after detailed explanation of study purpose and data collection procedures. The informed consent was

obtained from each participants participate in the study. The participants were informed that the participation in this study is voluntary and they can withdraw at any time without giving reasons. The purpose of the study was explained to the participants and they reassured that the obtained information will be confidential.

2.8. Data collection procedure: The data collection was carried out through the following steps:

Step 1: This step is concerned with preparing of the study tools for actual use for data collection after extremely reviewing of literature review that cover the various aspects of the problem using books, periodical articles, and network about studies related to diabetes self -care management behaviors.

Step 2: This step was concerned with the development of the educational intervention. The development educational intervention was conducted after inclusive reviewing of related information and within the context and concepts of Orem's self-care theory that considered as a theoretical framework for this study. The concepts are self-care demands or requirements, nursing agency, self-care agency and self-care. Self-care demands actions that should be performed for duration of time to meet known self-care requisites using valid methods and actions [32]. The contents of the educational intervention composed of variety brief, concise, clear, and understandable information and actions that meet the self-care demands of diabetic patients. These contents covered the following items: etiology, types, risk factors for T2DM, symptoms, diagnostic tools and common complications, eye care, foot care, monitoring blood glucose, appropriate diet, and importance of regular physical activity for T2DM, compliance with prescribed medication, performance self-care and effective follow-up of health care appointments. A concise brief pamphlet of the taught material was given to each patient, after implementation of the educational intervention.

Step 3: This step concerned with data collection and implementation of educational intervention. The implementation of the educational intervention carried out by the researchers (nursing agency) that have the abilities and well prepared with appropriate knowledge and skills to help patients to meet their therapeutic self-care demands that enhancing their own self-care agency [32]. Before data collection, informed consent was taken from each participant. The implementation of the educational intervention was carried out for the subjects of the study in groups. Each group was composed of 5-10 patients. The data collection (pre-intervention) and implementation of the educational intervention for each group took two consecutive days started from 9 am to 11 am, two groups per week. In the first day of each implementation, the researchers provide a brief explanation about the purpose of the study followed by distribution of the study tools to the patients who can self-fill. For those with low literacy level, they asked orally and the researchers filled it out. Then the researchers initiated the implementation of the first part of the educational intervention. By the end of first day, the researchers request the participants to come in the second day after overnight fasting for eight hours for a fasting blood glucose test and completing the implementation of the educational intervention. The researchers' telephone number was given to each participant for any question and follow-up for arrangement of post-intervention test and again fasting blood glucose test that carried out after 12 weeks from last session of each group using the same data collection tools to evaluate the compliance of the participants' to the activities of self-care (self-care concept according Orem' self-care theory). The process that applied for the first group was repeated with the second and third group, till the end of the data collection.

To enhance participants' self-care abilities (self-care agency according to Orem' self-care theory), the researchers were used a variety of teaching aids and methods in the implementation of the educational intervention that included lecture, group discussion, and demonstration. Power point presentation combined with videos and posters were used to enhance learning. The scoring of the collected data was carried out according to the previously mentioned system. The data of pre and post-intervention was calculated organized and compared using suitable statistical analyses to test the research hypothesis.

2.9. Study period: The study was conducted during 5 months from February 2018 to the end of July, 2018.

2.10. Statistical Analysis: After data collection, the data coded, organized and entered and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 20, SPSS Inc. Chicago, IL, USA). The qualitative data was presented in the form of number and percent. Descriptive statistics were carried out to the quantitative data. The quantitative data was presented in the form of number and percent; mean and standard deviation and the range. Paired samples t-test was used to compare the normally distributed quantitative data of two related groups. Comparison between data before and after the intervention was carried out using Marginal homogeneity test for quantitative non-parametric categorical variables. Pearson correlation coefficient test (r) was used to perform the correlation between quantitative variables. Significance was adopted at $p<0.05$ for interpretation of results of tests of significance.

3. RESULTS

Table 1: Distribution of socio-demographic characteristics of studied subjects

Socio-demographic characteristics	No.	(%)
Age(years):		
<40	11	(10.0)
40- 49	41	(37.3)
50 or more	58	(52.7)
Mean ±SD Range	49.36 ±6.99 34 - 62	
Gender		
Male	39	(35.5)
Female	71	(64.5)
Level of education:		
Illiterate	49	(44.5)
Basic education	26	(23.6)
Moderate education	30	(27.3)
High education	5	(4.5)
Marital status		
Single	14	(12.7)
Married	80	(72.7)
Divorced	7	(6.4)
Widowed	9	(8.2)
Occupation:		
Employment	33	(30.0)
Unemployment	67	(60.9)
Retired	10	(9.1)
Income level		
Easily enough	9	(8.2)
Enough for the need only	40	(36.4)
Not enough	61	(55.5)
Previous any form of diabetes education		
Yes	19	(17.3)
No	91	(82.7)

Table 1: Illustrates that the mean age of the study subjects was 49.36 ± 6.99 years, and about two thirds of them were female (64.5%). More than two thirds of subjects (68.1%) were low educated (illiterate and basic education), and the majority of subjects (72.7%) were married. More than half of them (60.9%) were unemployment and 55.5% of subjects were reported that monthly income is not enough. Most of the subjects (82.7%) reported that they not received any form of diabetic education.

Table 2: Distribution of clinical characteristics among the study subjects (n=110)

Clinical characteristics	No.	(%)
Family history of diabetes		
Yes	54	49.1
No	56	50.9
Duration of diabetes (years):		
<5	10	9.1
5- 9	64	58.2
10 or more	36	32.7
Mean ±SD	8.30 ±3.50	
Type of treatment		
Oral	73	66.4
Insulin	29	26.4
Both oral and Insulin	8	7.3
Diabetes related Complications		
No	63	57.3
Yes	47	42.7
Hypertension	23	20.9
Eye problem	15	13.6
Teeth problem	13	11.8
Renal problem	6	5.4

Table 2: Reveals that about half of the study subjects (49.1%) had reported positive family history of diabetes. The mean duration of diabetes among subjects was 8.30 ±3.50 years, and the majority of the subjects were treated with oral medication (66.4%). Diabetes related complications was 42.7% among the study subjects and the reported associated complication was hypertension (20.9%), followed by eye problem (13.6%) then teeth problem (11.8%) and renal problem (5.4%).

Table 3: Appraisal of Diabetes Scale items among the studied subjects (n=110)

Appraisal statements	No.	(%)
Having diabetes is stressful for you?		
Not at all	4	3.6
Slightly stressful	36	32.7
Moderately stressful	31	28.2
Very stressful	20	18.2
Extremely stressful	19	17.3
How much control over your diabetes?		
Total amount of control	2	1.8
Large amount of control	21	19.1
Moderate amount of control	44	40.0
Slight amount of control	23	20.9
None at all	20	18.20

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How much anxiety do currently experience as a result of having diabetes?		
Slight amount	22	20.0
Moderate amount	28	25.5
Large amount	40	36.4
Extremely large amount	20	18.2
How likely is diabetes worsen over the next several years?		
Slightly likely	31	28.2
Moderately likely	29	26.4
Very likely	30	27.3
Extremely likely	20	18.2
Do you think your control of diabetes is the result of own effort?		
Mostly because of me	10	9.1
Partially because of me and partially because of other factors	51	46.4
Mostly because of other factors	29	26.4
Totally because of other factors	20	18.2
To what degree does diabetes get in the way of your developing life goals?		
Not at all	4	3.6
Slight amount	29	26.4
Moderate amount	28	25.5
Large amount	39	35.5
Extremely amount	10	9.1
How effective are you in coping with diabetes?		
Extremely effective	1	0.9
Very effective	41	37.3
Moderately effective	29	26.4
Slightly effective	20	18.2
Not at all	19	17.3
Total score of appraisal diabetes (Mean ±SD)	23.42±6.55	
Degree of appraisal		
Positive view (≤50%)	39	35.5
Negative view > 50%	71	64.5

Table 3: Illustrates that more than one third of the subjects (35.5) were perceived diabetes as very stressful and extremely stressful for them, 60.9% of subjects reported moderate to slight amount of control on their diabetes. More than half (54.6%) of subjects experience large amount and extremely amount of anxiety as a result of diabetes. Additionally, less than half (45.5%) reported that diabetes is very likely and extremely likely worsen over the next several years and less than half (46.4%) think that control of their diabetes is partially because of themselves and partially because of other factors. Less than half (44.6%) of the subjects reported that diabetes get in the way of developing their life goals by large amount and extremely amount, and about two thirds (63.7%) of subjects reported very effective to moderately effective in coping with diabetes. Regarding the degree of appraisal, the finding of table shows that about two thirds of subjects (64.5%) had negatively appraised their diabetes, indicated that the subjects perceived diabetes as stressful and harmful for their daily life. The findings of the table provide answer to the first research question.

Table 4: Distribution of pre and post-intervention patients' knowledge about diabetes

Diabetes knowledge items	Pre-intervention		12 weeks post-intervention		Test & P value
	Correct	Incorrect	Correct	Incorrect	
	No. (%)	No. (%)	No. (%)	No. (%)	
Eating too much sugar and sweet foods is a cause of diabetes	50 (45.5)	60 (54.5)	100 (90.9)	10 (9.1)	X^2 =48.0 P<0.001
The common cause of diabetes is a lack of insulin resistance in the body	14 (12.7)	96 (87.3)	71 (64.5)	39 (35.5)	X^2 =51.4 P<0.001
Diabetes is caused by failure of the kidneys in keeping the urine without sugar	21 (19.1)	89 (80.9)	80 (72.7)	30 (27.3)	X^2 =57.0 P<0.001
The kidneys produce insulin	22 (20.0)	88 (80.0)	76 (69.1)	34 (39)	X^2 =42.6 P<0.001
The amount of blood sugar increases in untreated diabetes	64 (58.2)	46 (41.8)	94 (85.5)	16 (14.5)	X^2 =16.2 P <0.001
Children of a person with diabetes are at greater risk to be diabetic	68 (61.8)	42 (38.2)	100 (90.9)	10 (9.1)	X^2 = 30.0 P<0.001
Diabetes can be completely cured	40 (36.4)	70 (63.6)	104 (94.5)	6 (5.5)	X^2 =62.0 P<0.001
A fasting blood sugar level of 210 is too high	42 (38.2)	68 (61.8)	81 (73.6)	29 (26.4)	X^2 =33.6 P<0.001
The best way to check diabetes is by testing urine	66 (60.0)	44 (40.0)	86 (7.2)	24 (21.8)	X^2 = 8.6 P<0.001
Regular exercise lead increases the need to take more diabetic medication	40 (36.4)	70 (63.6)	84 (76.4)	26 (23.6)	X^2 =36.9 P<0.001
There are two main types of diabetes: Type 1 (insulin-dependent) and Type 2 (non-insulin-dependent)	22 (20.0)	88 (80.0)	81 (73.6)	29 (26.4)	X^2 = 502 P<0.001
Low blood sugar is caused by too much food	72 (65.5)	38 (34.5)	90 (81.8)	20 (18.2)	X^2 = 44.5 P<0.001
Medication is more important than diet and exercise to control diabetes	58 (52.7)	52 (47.3)	80 (72.7)	30 (27.3)	X^2 = 22.7 P<0.001
Diabetes often causes poor circulation.	31 (28.2)	79 (71.8)	94 (85.5)	16 (14.5)	X^2 = 61.0 P<0.001
Wounds heal slowly in the person with diabetes 9	52 (47.3)	58 (52.7)	87 (79.1)	23 (20.9)	X^2 = 33.2 P<0.001
Diabetics should take special care when cutting their toenails	60 (54.5)	50 (45.5)	90 (81.8)	20 (18.2)	X^2 = 40.0 P<0.001
A person with diabetes should clean a wound with an iodine solution and alcohol	30 (27.3)	80 (72.7)	94 (85.5)	16 (14.5)	X^2 = 62.0 P<0.001
The way of preparing food is as important as foods eating	60 (54.5)	50 (45.5)	93 (84.5)	17 (15.5)	X^2 = 31.0 P<0.001
Diabetes can damage the kidneys	36 (32.7)	74 (67.3)	70 (63.6)	40 (36.4)	X^2 = 27.2 P<0.001
Diabetes can lead to loss of sensation in the hands, fingers and feet	59 (53.6)	51 (46.4)	85 (77.3)	25 (22.7)	X^2 = 24.0 P<0.001
Tremors and sweating are signs of high blood sugar	30 (27.3)	80 (72.7)	75 (68.2)	35 (31.8)	X^2 = 36.5 P <0.001
Frequent urination and thirst are signs of low blood sugar	53 (48.2)	57 (51.8)	92 (83.6)	18 (16.4)	X^2 = 33.0 P<0.001
Tight elastic socks are not harmful for diabetics	35 (31.8)	75 (68.2)	84 (76.4)	26 (23.6)	X^2 = 41.9 P<0.001
A diabetic diet consists mostly of special foods	60 (54.5)	50 (45.5)	86 (78.2)	24 (21.8)	X^2 = 17.4 P <0.001
Diabetic knowledge level:					
Satisfactory	28 (25.5)		93 (84.5)		X^2 = 52.5 P <0.001
Unsatisfactory	82 (74.5)		17 (15.5)		
Total score of knowledge (Mean ± SD)	9.79 ± 4.17		18.72 ± 3.45		t =20.71 P <0.001

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Table 4: Shows that in pre intervention, large percentage of the study subjects had incorrect response across all items of diabetes knowledge, and the percentage ranged from 36.4 to 87.3%. The most items with highest rate of incorrect answer were those that related to the causes and types of diabetes, wounds healing and cleaning, consequences of diabetes on the circulation and kidney, suitable value of fasting blood glucose level, production of insulin, feet care, items related to eating pattern, signs of hypo and hyperglycemia items, exercise and cure from diabetes. In post-intervention, the majority of subjects had correct response across all items of diabetes knowledge with statistically significant difference between pre and post intervention. The parentage of subjects who achieve correct responses ranged from 63.6% to 90.9%.

Regarding diabetic patients' knowledge level, the same table shows that, in pre- intervention, the majority (74.5%) of the study subjects had unsatisfactory knowledge about diabetes; while in post-intervention, the majority diabetic patients (84.5%) had satisfactory knowledge with statistically significant difference between pre and post intervention (P <.001). Also, this table shows that there was significant improvement in the mean score of patients' knowledge in post-intervention (18.72 ± 3.45) compared to pre intervention (9.79 ± 4.17), P <.001. These findings indicate the positive effect of diabetes self-care management educational intervention based on Orem Self Care theory on patients' knowledge, which provide support to the first research hypothesis.

Table 5: Pre and post-intervention mean score of diabetes Self-care management subscales.

Subscales of diabetes Self-care management	Pre-intervention	12 weeks post-intervention	Test P Value
	Mean ± SD	Mean ± SD	
Dietary control	5.45 ± 2.70	7.62 ± 2.76	t = 9.62 P <0.001
Glucose monitoring	3.19 ± 1.32	3.22 ± 1.29	t =1.75 P = .083
Medication Adherence	4.65 ± 1.13	5.24 ± 0.78	t =7.93 P<0.001
Physical activity	4.36 ± 2.25	6.50 ± 1.90	t =13.76 P<0.001
Health care use	4.44 ± 1.42	6.18 ± 1.78	t = 11.7 P <0.001
Total score of self-care management (48)	22.14 ± 7.21	31.12 ± 7.31	t = 16.01 P<0.001
Degree of self-management	No. (%)	No. (%)	
Poor self-care management (0-16)	54 (49.1)	10 (9.1)	MH = 8.43 P<0.001
Moderate self-care management (17-32)	36 (32.7)	38 (34.5)	
Good self-care management (33-48)	20 (18.2)	62 (56.4)	

t = Paired Samples T Test, MH = Marginal Homogeneity Test

Table 5: Shows that in the pre-intervention the majority of the subjects (81.8%) had poor to moderate self-care management, while in post-intervention the majority of the subjects (90.9%) had moderate to good self-care management, with statistically significant difference between pre and post-intervention mean total score of all domains (dietary control, medication adherence, physical activity, health care use) of self-care management, except glucose monitoring domain. These finding indicated the significant effect of the educational intervention on subjects' self-care management. Moreover, a significant improvement in the mean total score of self-care management in post-intervention (31.12 ± 7.31) compared to the mean total score of self-care management in pre-intervention (22.14 ± 7.21), P <.001. The findings of the table provide support to second research hypothesis.
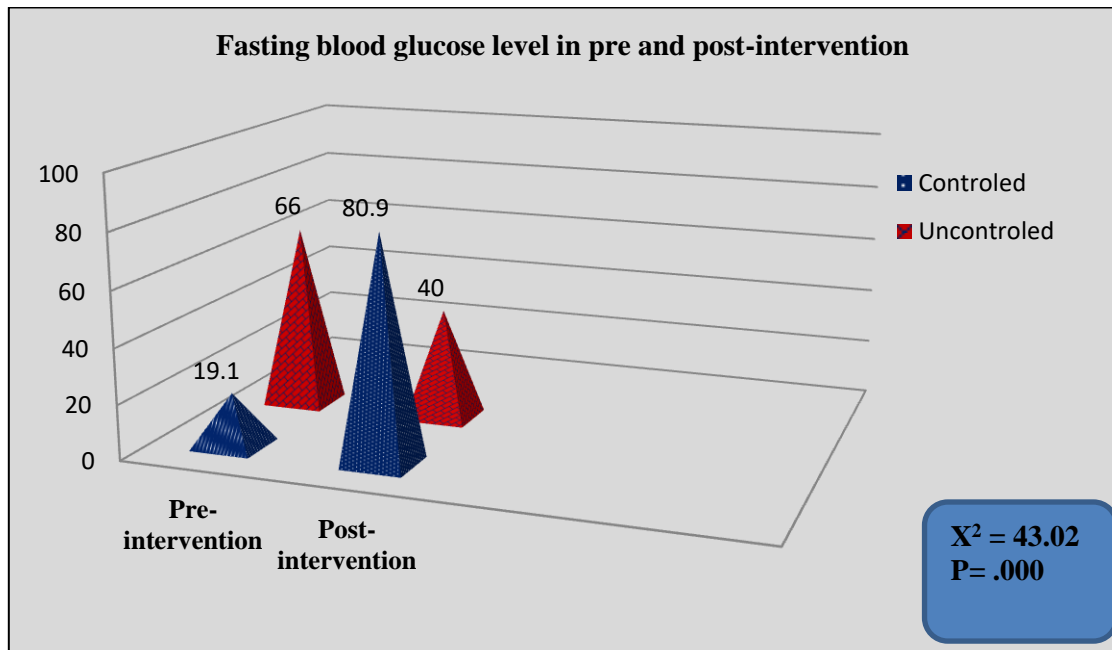
X^2 = chi-square Test

Figure 2: Fasting blood glucose status in pre and post-intervention among study subjects.

Figure 2: Represents a statistical significant increase in the percentage of subject with controlled fasting blood glucose (19.1%) after self-care educational intervention based on Orem Self Care theory, compared to the percentage of subject with controlled fasting blood glucose (80.9%) before the educational intervention, P= .000. This finding indicates the improvement in self-care management among patients with T2DM as a result of the provided educational intervention. This finding provides support to the second and the third research hypotheses.
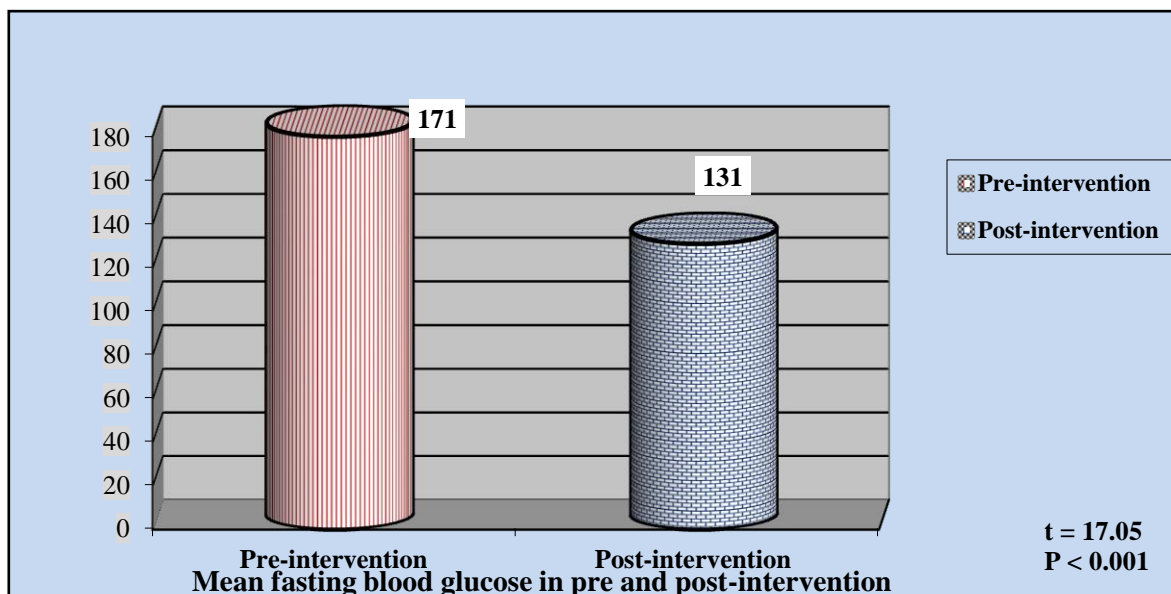
Figure 3: Mean fasting blood sugar in pre and post-intervention among study subjects

Figure 3: Reveals statistical significant decrease in the mean fasting blood sugar (131 mg/dL ± 27.37) after educational intervention based on Orem Self Care theory about diabetes self-care management, compared to the mean fasting blood sugar (171 mg/dL ± 42.52) before the intervention, p = .000. The significant decrease in the mean fasting blood glucose in post-intervention provides support to the third research hypotheses.

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Table 6: Pearson correlation (r) matrix of appraisal of diabetes, duration of diabetes, diabetes knowledge, Fasting blood glucose in pre-intervention and self-care management of diabetes

Variables	Appraisal of diabetes	Pre-intervention total score of self-care management	Pre-intervention total score of knowledge	Fasting blood glucose in pre-intervention	Duration of diabetes
Appraisal of diabetes					
Pre-intervention total score of self-care management	r= -.821[*] P= .000				
Pre-intervention total score of knowledge	r= -.435[*] P= .000	r= .520[*] P= .000			
Fasting blood glucose in pre-intervention	.431[*] P= .000	-.504[*] P= .000	-.253[*] P= .008		
Duration of diabetes		r= .310[*] P= .001	r= .270[*] P= .004		

* Correlation is significant at the 0.01 level (2-tailed).

Table 6: Shows that there was a significant negative correlation between score of appraisal of diabetes and the score of diabetes self-care management (r =-.821, P= .000). This indicates that the lower the score of appraisal of diabetes (positive appraisal), the higher score of diabetes self-care management. This finding provides answer to the second research question. Moreover, appraisal of diabetes negatively correlated with pre-intervention total score of knowledge and positively with fasting blood sugar in pre-intervention, r= -.435 and .431 respectively, P < 0.01. Pre-intervention total score of self-care management was negatively correlated with fasting blood sugar in pre-intervention and positively with pre-intervention total score of knowledge and duration of diabetes; r= -.504, .520 and .310 respectively, P < 0.01. Fasting blood sugar in pre-intervention was negatively correlated with pre-intervention total score of knowledge, r= -.253-, P < 0.01.

4. DISCUSSION

Diabetes is contributing to the global burden of complications [4]. These complications mostly associated with sedentary lifestyle, unhealthy dietary habits, skipping doctor's appointment, noncompliance with prescribed medication [41]. Thus, it is necessary to provide an optimal care for diabetes patients through self-management interventions that include set of self-management skills [42]. Therefore, this study was conducted to examine the effectiveness of self-care education intervention based on Orem Self Care theory on self-care management and level of fasting blood glucose among patients with T2DM and determine the relationship between appraisal of diabetes and self-care management among patients with T2DM.

As regards clinical characteristics of study subjects, the findings of present study revealed that about half of the study subject had reported positive family history of diabetes. This finding was in agreement with [43] who revealed that the family history of diabetes was reported by forty percent of the diabetic patients in Bengaluru city. Similarly, Ahmed et al., 2017 [44] in Port Said City- Egypt found that seventy five percent of patients with type 2 had family history of diabetes. Moreover, the finding of the current study showed that the mean duration of diabetes among the study sample was 8.30 ±3.50 years. This result was consistent with [45] who reported that average duration of diabetes mellitus was 9.2 years among patients with T2DM in Shanghai, China. Concerning treatment of diabetes, the present study showed that two thirds of the study subjects were treated with oral medication, this result was in line with [46] who revealed that sixty four percent of Japanese patients with T2DM were treated with oral hypoglycemic. Similarly, Saad et al., 2018 [47] found that current pharmacological treatment in more than half of diabetic patients attending the Sultan Bin Abdulaziz Humanitarian City in Riyadh, Saudi Arabia was oral hypoglycemic medications. Concerning diabetes related complications; the present study showed that more than forty percent of patients with T2DM had diabetes related complications. This finding was in agreement with [43] who reported that diabetes related complications were prevalent in about forty two percent.

Regarding Appraisal of diabetes among T2DM patients, the present study showed that the majority of subjects had a higher score in their appraisal of diabetes that represents a more negative appraisal of diabetes and they perceived diabetes as stressful and harmful for their daily life. This finding was supported with what has been documented in the literature by [48,49, 50] they reported that having diabetes is associated with high level of distress. In contrast, a study conducted by [11] they found that Rural Appalachian Adults with T2DM perceived diabetes as a challenge more than being a threat, harm, or stressor. Also they found that overall sample had a lower level of distress related to the diagnosis of diabetes. The difference between the result of the present study and their study may be related to variation in the level of education and health literacy among the subjects of the two studies. Concerning relation between appraisal of diabetes and self- care management, the present result revealed that negative appraisal of diabetes among study subjects was associated with lower practices of diabetes self-care management in pre-intervention. This finding was supported by what has been documented in the literatures, that diabetes related distress affects self-management of diabetes [51, 52].

Concerning patients' knowledge about diabetes, the current findings revealed that in pre-intervention, the most items with highest rate of incorrect answer were those that related to the causes, types of diabetes, wounds healing and cleaning, consequences of diabetes, suitable value of fasting blood glucose level, production of insulin, feet care, items related to eating pattern, signs of hypo and hyperglycemia items, exercise, cure from diabetes. These findings were in agreement with many studies [53] found that the majority of participants had wrong answer in the item related to causes of diabetes included sugar and sweet foods as a cause of diabetes and difficulty of the kidneys' in keeping the urine without sugar is a cause diabetes, signs of hypoglycemia and hyperglycemia, production of insulin, effect of regular exercise. Likewise, Basu et al., 2017 [54] revealed that the majority of the diabetic patients in government hospitals of Delhi were unaware of the symptoms of hypoglycemia. Also, Shrivastava et al., 2015 [55] reported that about half the subjects had incorrect knowledge about diabetes is a curable disease. Moreover, Dinesh et al., 2016 [56] reported that seventy percent of diabetics were not aware of the consequences of diabetes including neuropathy, skin infection, and ophthalmic problems. Similar to the result of [57] revealed that the majority of older adults with diabetes in Beijing, China subjects had wrong answer about effect of regular exercise on diabetes. On the other hand, concerning patient knowledge about a suitable value of fasting blood glucose level, the current study was inconsistent with [53,57]   they reported that a higher percentage of diabetic patients knew the correct answers about the suitable value of fasting blood glucose level. The difference may be related to variation in socio-demographic characteristics of the current study subjects and their study subjects.

Concerning the total level of diabetic patient knowledge, the present result revealed that, most of the study subjects had unsatisfactory knowledge about diabetes. This finding was in line with [58] reported that the knowledge scores of patients with T2DM were not satisfactory. Similarly with a study in India by [54] concluded that the knowledge of diabetic patients attending government hospitalsis was low. Likewise, Dinesh et al; 2016 [56] revealed that only about one-fourth of diabetics patients in rural Sullia, Karnataka had a good knowledge. Therefore, educational interventions can play an important role to improve patients' knowledge and skills about diabetes self-management. Systematic reviews of interventions about diabetes self-management indicate that the diabetes education intervention improve knowledge, and self-care behaviors [59].

Concerning effect of self-care educational intervention based on Orem's self -care theory on diabetic patients' knowledge, the current finding reported that after implementation of self-care educational intervention based on Orem's self -care theory on diabetic patients' knowledge, there was a significant improvement in the knowledge of patients across all items of diabetes compared to pre intervention. Also, there was a significant improvement in the mean score of patients' knowledge at post-intervention compared pre intervention. The current findings indicated a significant positive effect of the educational intervention based on Orem Self Care theory on diabetic patients' knowledge. This result was in agreement with [60] who revealed that after implementation of the culture-oriented educational program among patients with T2DM in Bangladesh, there was a significant improvement in knowledge of the patients towards all aspects of diabetes and the mean score of knowledge of the patients improved significantly. Similar to the result of [44] in Egypt concluded that after implementation of the educational intervention, there was a significant improvement in patients' knowledge about diabetes, the mean of total knowledge score also increased and marked improvement in the patient awareness regarding different aspects of diabetes was observed. Additionally, Wichit et al., 2017 [61] found that a theoretically-derived family-oriented educational program for Thai individuals with T2DM, significantly improve

patients' diabetes knowledge. Likewise, finding of [62] showed that family interventions improved knowledge of diabetes among adult with T2DM. Furthermore, Barasheha et al., 2017 [63] concluded that after the educational intervention based on precede-proceed model, the average score of knowledge of patients with T2DM in Bavi city, Iran was significantly increased in the intervention group. Moreover, Azar et al., 2018 [64] revealed that diabetes self-management programs have been found to be effective in improving knowledge of individuals with T2DM.

Regarding patients with T2DM self -care management levels, the finding from the present study showed that in the pre-intervention, half of study subjects had poor level of self-care management and about one third had moderate level. The present result was in agreement with [65] who reported that the self-management of more than half of T2DM sample in Indonesia was classified as poor level. Also, Karaoui et al., 2018 [58] found that the self-management practices scores of patients with T2DM were not satisfactory and sixty nine percent of subjects had a poor self-care ability, while twenty three percent had a moderate ability. Also, Similar to the result of [18] indicated that most of Omanis participants with T2DM had an inadequate level of self-management. On the contrary, Mohammed-Ali et al., 2016 [66] reported that patient with T2DM who visit Al-Sadder Medical City/ Al-Najaf center for diabetes had moderate self-care activities. The difference may be due to the most of participants in the present study not received previous diabetes self-care management educational intervention and most of subjects were illiterate and basic education.

Education is a process that can reduce the gap between patient's information about diseases and practices. Providing sufficient information and adequate guidelines is of a great effect on enhancement of the patients' ability to perform self-care activities [60]. The present finding showed that 12 weeks after self- care educational intervention based on Orem's self -care theory, a significant improvement in mean total score of self-care management activities including dietary control, medication adherence, physical activity, health care use, but there is no significant improvement in glucose monitoring domain. Moreover, a significant improvement in the mean total score of self-care management in post-intervention (31.12 ± 7.31) compared to the mean total score of self-care management in pre-intervention (22.14 ± 7.21). The present results were consistent with [67] in Turkey, they reported that after self-management education based on self-care deficit nursing theory, the self-care activities of the individuals with diabetes in intervention group were improved. Likewise, result of the study in Thailand [61] found that family-oriented educational program can significantly improve diabetes self-management in individuals living with T2DM. Similar to the finding of [64, 68] they reported that diabetes self-management programs have been effective in improving self -care activities among individuals with T2DM. Additionally, a study in Khoramabad, Iran by [69] found significant improvement in nutrition, physical activity and monitoring blood glucose after training intervention among T2DM patients. However, the present result was inconsistent with [60, 69] who found a significant improvement in monitoring blood glucose but the present study did not revealed significant difference between pre and post intervention as regarding blood glucose monitoring. The difference may be due to the cost of test strips and other devices needed self- monitoring blood glucose.

On the other hand, the current result revealed a significant positive correlation between score of diabetes related knowledge and the score of diabetes self-care management that indicated; the higher the score of diabetes knowledge was linked to higher score of diabetes self-care management. This finding was consistent with [58] found that knowledge and self-care practice of diabetes were significantly correlated. Moreover, similar results were reported in Australia by [70] and in Indonesia by [65] they reported positive significant correlations between diabetes knowledge and diabetes self-management. As regard relation between self -care management and duration of diabetes, the present result revealed a significant positive correlation between the score of diabetes self-care management and duration of diabetes. This indicated that long the duration of diabetes was associated with higher score of diabetes self-care management. This result was in accordance with [71] who found that diabetes self -care management behaviors were associated with length of diagnosis among Jordanian patients with T2DM. This result can be explained that by the time the subjects may acquire the experience to improve their diabetes self- care management.

Regarding the effect educational intervention based on Orem Self Care theory about diabetes self-care management on fasting blood glucose, the current study revealed significant decrease in fasting blood glucose level in 80.9% of diabetic after 12 weeks from the educational intervention compared to 19.1% before intervention. Also, a significant reduction in mean fasting blood glucose level in post- intervention compared pre-intervention. This finding was in agreement with those of [72] in India, they revealed significant reduction of mean fasting blood glucose levels in the group received pharmacist intervention. Similar to the result of study in Port Said City, Egypt [44] reported significant decrease in the

mean levels of fasting blood glucose and HbAlc among patients with T2DM three months post educational intervention. The results of current study and the other supporting studies indicated the positive effect of diabetes related educational interventions in improving the knowledge, self-care practices as well as glycemic control among patients with T2DM.

5. CONCLUSION

The implemented self-care educational intervention based on Orem Self Care theory has significantly increase the percentage of diabetics with satisfactory level of knowledge from 25.5% to 84.5% after the educational intervention and the percentage of diabetics with good level self-care management form18.2% to 56.4% as well. Also, a significant control in the mean fasting blood glucose from 171 mg/dL ± 42.52 to 131 mg/dL ±27.37 was revealed. Negative appraisal of diabetes was associated with decreased diabetes self-care management.

6. RECOMMENDATIONS

Based on the finding of the present study the following recommendations are essentially required:

- At the level of nursing practices: Health care providers should promote diabetes self- care programs to enhance diabetic's self- care practices and limit diabetes related complications.

- At the level of nursing education: Incorporate the application of a theoretical framework in the basic educational programs for nursing students to provide them with a theoretical framework that guide their future practice.

- At the level of nursing research: The theory-based approaches of patients' education require further studies to investigate its effectiveness in nursing practice.

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