

EFFECT OF AN EDUCATIONAL PROGRAM ON KNOWLEDGE, PRACTICE, AND SELF-EFFICACY OF PATIENTS WITH TYPE 2 DIABETES MELLITUS

Samah Mahmoud Mohamed El-Sayed¹, Nadia Mohamed Taha²,
Mohamed Nagibe Mahmoud Elkhatab³, and Maha Desoky Saleh Sakr⁴

¹ Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt.

² Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt.

³ Tropical Medicine, Faculty of Medicine, Zagazig University, Egypt.

⁴ Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt.

ABSTRACT

Background and aim of the work: Diabetes mellitus is a chronic illness with high morbidity, and mortality, and high public health burden. Diabetes education should include some psychosocial factors such as patient's self-efficacy, which might have a significant effect on a patient's adherence to self-management practice. The aim of This study was to evaluate the effect of an educational program on knowledge, practice, and self-efficacy for patients with type 2 diabetes mellitus.

Subjects and Methods: A quasi experimental research design was used in this study. The study was conducted in diabetic outpatient clinics of Al-Ahrar Hospital. A purposive sample of 60 patients with type 2 diabetes mellitus. The study lasted from the beginning of March 2016 to the end of February 2017. Four tools were used for collection of data; 1st tool was diabetic patient's assessment and clinical data, 2nd tool was diabetic patients' knowledge questionnaire, 3rd tool was diabetic patients' self-reported practice, and 4th tool was diabetes Management Self-Efficacy Scale.

Results: There were statistically significant improvements in patients' knowledge ($p=0.000$), self-reported practice ($p=0.000$), and self-efficacy ($p=0.000$) post-program implementation with slight decline in follow-up phase.

Conclusion: The study demonstrated that the educational program had a statistically significant effect on knowledge, practice, and self-efficacy for patients with type 2 diabetes mellitus. Additionally, promoting diabetic patients' personal motivation and self-efficacy could improve their practices, with subsequent positive effects on health outcomes and diabetes control. Therefore, the study recommended generalization of such educational program on all health care settings providing services to T2DM patients. The developed illustrated booklet should be available and distributed for each diabetic patient in all health care settings providing services for diabetic patients. A continuous assessment of diabetic patients' self efficacy should be integrated as a part of treatment plan by trained nurses.

Key words: Educational program, Type 2 diabetes mellitus, Knowledge, Self-reported practice, Self-efficacy

Introduction:

Diabetes mellitus (DM) is a chronic illness with high morbidity and mortality, with high public health burden. It is also a debilitating and life-threatening disease accounting in 2015 for the death of 5 million people worldwide. According to a recent report, 420 million people

worldwide have diabetes of whom 90% are diagnosed with T2DM, with a projected global prevalence of 642 million by 2040. This represents a huge societal and financial burden on healthcare systems [1]. Egyptian statistics showed that diabetes which is the eleventh most

important cause of premature mortality and is the sixth most important cause of disability burden in Egypt by the year 2030, it will affect at least 8.6 million adults, which are responsible for 2.4% of all years of life lost [2]. DM is a major endocrine-related disorder comprises a group of metabolic disorders exhibiting hyperglycemia over an extended period. It is also characterized by a state of relative or complete insulin deficiency leading to gross defects in glucose, fat, and protein metabolism. However, good glycaemic control is able to prevent or control DM complications [3]. This requires changes in patient's daily routine with many self-care activities concerning medications, glucose testing, nutrition, exercise, and foot care. Diabetic patients need guidance to be able to pursue the life-long management of their illness. Therefore, diabetic patients' education should be concerned with encouraging self-dependence and confidence to enable them to carry out their self-care tasks [4].

Self efficacy (SE) is an individual's capabilities to complete a specific task or goal. It is also valuable predictor of diabetes self care and a key tenet in the Social Cognitive Theory. SE for diabetes management reflects an individual's confidence in his or her ability to perform self-care behaviors including knowledge and attitudes. Increasing SE will allow patients to take control of their disease and help them understand the importance of their self-management role. SE is widely accepted as an important factor for diabetes treatment as it is associated with improved treatment adherence, diet regimen, physical activity, blood glucose testing, and foot care among diabetic patients [5]. Hence, the measurement of SE can help in the prediction the intention to change and to select proper self-care interventions [6].

Traditional diabetic education focused on transfer of knowledge and skills. However,

they aren't enough to empower patients to incorporate the necessary self-care skills into their daily living. Therefore, it is recommended that diabetes education include some psychosocial factors, such as patient's SE, which might have a significant effect on patients' adherence to self management practice [7].

Significance and aim of the study:

Management of type 2 diabetes mellitus is challenging and often requires skillful integration of complex treatment regimen such as healthy diet, regular exercise, optimum weight control, self monitoring of blood glucose, hygienic and foot care, and medication adjustment into the daily routine over long periods [8]. Adherence to recommended management routines of chronic diseases can be enhanced by increasing self-efficacy. Providing an educational program for diabetic patients may promote self-efficacy as well as promoting their glycaemic control and reducing diabetic complications. The aim of this study was to evaluate the effect of an educational program on knowledge, practice, and self-efficacy for patients with type 2 diabetes mellitus. The research hypotheses are that the implementation of educational program will lead to statistically significant improvements on T2DM patients' knowledge, practice, and self-efficacy.

SUBJECTS AND METHODS

Study design and setting:

The study was conducted in diabetic outpatient clinics of Al-Ahrar Hospital using a quasi experimental design. Field work of this study was executed in 12 months, started from March 2016 and lasted to February 2017. Patients were evaluated at three time intervals: before, post, and 3 months after intervention.

Subjects:

A purposive sample of 60 patients T2DM who had T2DM for at least one year, age ranged between 20-60 years old, both sexes were involved, able to comprehend

and communicate, and agreed to participate in the study.

Data collection tools:

The researchers used four tools.

Tool I: Diabetic patient's assessment and clinical data tool was developed by the researchers based on related literature and included three main parts:

- **Part 1:** Demographic characteristics of patients with regard to age, sex, marital status, residence, educational level, and occupation.
- **Part 2:** Anthropometric measurements and lab tests as (height, weight, body mass index, and random blood sugar).
- **Part 3:** Medical and family history of patients such as (duration of diabetes, family history of diabetes, present complications, number and cause of previous hospitalization for DM, prescribed medications, etc.).

Tool II: Diabetic patients' knowledge questionnaire (Pre/Post test). It was developed by the researchers after reviewing recent and relevant literatures based on Poretsky [9], Abdel-Razik [10], Brownlee et al., [11], and Rosdahl, Bunker, & Kowalski [12]. It was used to assess diabetic patients' knowledge regarding DM related to overview, complications, dietary regimen, physical exercises, drug therapy, laboratory investigations, hygienic care, foot and nails care, wound care, and follow up. Total patient's knowledge score were considered satisfactory at a cutoff point 50% or more and unsatisfactory if it was < 50%.

Tool III: Diabetic patients' self-reported practice (Pre/Post test): It was adapted by researchers from Schmitt, Gahr, & Hermanns [13], Girouard [14], Salzman, Collins, & Hajjar [15], and Weinger & Carver [16]. It was used to assess diabetic patients' self reported practice of the eight aspects of diabetes care and management of DM complications with 107 items. Total patients' self reported practice scores were considered adequate at a cutoff point 60% or higher and inadequate if < 60%.

Tool IV: Diabetes Management Self-Efficacy Scale (pre/post test): It was adapted by researchers from Van der Bijl, Van Poelgeest-Eeltink, & Shortridge-Baggett [17] to evaluate patient's confidence in doing certain activities as check blood sugar if necessary. It composed of 20 items on a 10-points continuous scale ranging from "1" (not confident at all) to "10" (totally confident). Total patient's self-efficacy was considered adequate if the percent score was $\geq 60\%$ and inadequate if the percent score < 60%.

Fieldwork

The study was implemented from March 2016 to February 2017 where the researchers were available three days weekly from 9 am to 1 pm.

Assessment phase: The researchers started to recruit the sample according to eligibility criteria. Those who gave their consent were interviewed individually using the data collection form. The information obtained served as baseline data or pretest, and guided the researchers in the preparation of the educational program.

Planning phase: The researchers developed the educational program based on patients' needs which identified in the assessment phase and review of relevant literature for improving patients' knowledge, self reported practice, and related self-efficacy. The researchers prepared an illustrative booklet in simple Arabic language to help patients assimilate and refresh the provided information to achieve aim of the study.

Implementation phase: The researchers grouped patients; each group included 4-5 patients, and administered the educational program in 25 sessions. Each session lasted 45 minutes. One patient's family member attended the sessions to help patient follow the prescribed instructions at home. The first session was for orientation about the program. This was followed by 7 sessions for the theoretical

part which included 4 sessions covered definition of DM, its causes, types, clinical manifestations, complications, dietary regimen, physical exercises, treatment, laboratory investigations, as well as, hygienic care, foot & nail care, wound care, and goals of follow-up visits. In addition, 3 sessions for enhancing patients' self-efficacy. Whereas the remaining 17 sessions were for the practical part which involved dietary regimen, physical exercises, medication administration, insulin self injection, blood and urine glucose testing, hygienic care, foot care, wound care, and periodical follow-up. The researchers used simple language to suit patients' level, with motivation and reinforcement during sessions to enhance learning. A copy of the booklet was provided to each patient on the first day of the program to use it as future reference.

Evaluation phase: Each patient in the study was evaluated 3 times using the same data collection tools; one before the program (Pretest), second occurred one month after completion of the educational program (Posttest), and 3 months after the end of the program (follow-up test).

Content validity and Reliability:

Content validity was used for the data collection tools to determine whether the tools covered the aim or not. It developed by a jury of 5 experts three professors from faculty of Nursing, Zagazig University and two professors from Faculty of Medicine, Zagazig University. Reliability was done by using Cronbach test and retest. Knowledge questionnaire, self-reported practice, and Diabetes Management Self-Efficacy Scale showed a high level of reliability with Cronbach alpha coefficient 0.87, 0.89, and 0.85, respectively.

Administrative and Ethical considerations:

Necessary approvals to conduct the study were secured using official channels. The study protocol was approved by the

research and ethics committee at the faculty of nursing, Zagazig University.

Statistical Design:

Data entry and statistical analysis were done using SPSS 20.0 statistical software package. The statistical significance and associations were assessed using arithmetic mean, standard deviation (SD), Pearson chi-square test (X^2), Wilcoxon Signed Ranks test (Z test), Cronbach alpha coefficient, and Spearman rank correlation.

RESULTS

The first part of our results was demographic characteristics of studied patients. It illustrated that (70.0%) of patients were females and their age ranged from 32 to 60 years old, with mean \pm SD (48.77 \pm 9.00). More than three quarters (76.7%) of patients were married, (75.0 %) lived in rural areas, (51.7 %) were illiterate, while 13.3% had university education, and (63.3%) were housewives (Table 1).

The second part of our results was medical and family history of studied patients. It illustrated that the duration of DM was for more than ten years (43.3%), and (71.7%) of patients had positive family history. All patients had DM complications, mostly eye complications (76.7%), and hypertension as well as dental complications (75.0%). All patients had previous hypoglycemic and hyperglycemic attacks, caused mainly by delayed meal (75.0%) and psychological stress (80.0%), respectively. One third (33.3 %) of patients was previously hospitalized for hyperglycemia. More than one half of patients (56.6%) were on tablet whereas (21.7 %) were on insulin or on both tablet and insulin treatment. More than half (58.4%) of patients were obese (Table 2). The third part of our results was concerned with patients' knowledge regarding DM in the study sample throughout the study phases. It revealed that the total mean scores of studied patients' knowledge pre-

program was (24.20±13.02) and increased to (109.93±13.20) post program with slight decline to (104.27±17.89) in follow-up phase. However, these improvements in total mean scores of knowledge were statistically significant from pre/post and from pre/follow up test with P value 0.000 (Table 3).

The fourth part of our results was concerned with patients' self-reported practice regarding DM in the study sample throughout the study phases. It indicated that the mean scores of total self-reported practice was (12.18±8.09) in the pre-program, increased to (71.73±11.37) in post-test phase, and decreased to (68.22±12.30) in follow-up phase; however, these improvements in total mean scores of self-reported practice were statistically significant from pre/post and from pre/follow up test with P value 0.000 (Table 4).

The fifth part of our results was concerned with patients' self-efficacy as regards DM among patients in the study sample throughout the study phases. It showed that all of studied patients had inadequate self-efficacy in pre program phase. While more than three quarters (78.3%) and about two thirds (65.0%) of patients had adequate self-efficacy in post and follow-

up program phase, respectively. Moreover, this table also confirmed that there was a highly statistically significant difference between pre/post and pre/follow up program phase as regards the total score for studied patients' self-efficacy with p value 0.000 (Table 5).

The sixth part of our results portrayed that there was a highly positive statistically significant correlation between patients' duration of diabetes and their number of present complications ($r = -0.853$ at p value 0.000). This means that the longer duration of diabetes, the more complications occurrence. As well, concerning post program phase, there was a strong highly statistically significant correlation between patients' knowledge and self-reported practice ($r = 0.849$ at p value 0.000). However a strong highly statistically significant correlation between patients' self-reported practice and self-efficacy was detected post program ($r = 0.941$ at p value 0.000). Also, there was a strong highly statistically significant correlation between patients' knowledge and self-efficacy post program ($r = 0.800$ at p value 0.000) (Table 6, 7).

Table (1): Frequency and Percentage Distribution of Demographic Characteristics of Patients in the Study Sample (n=60).

Demographic characteristics	NO	%
Age:		
< 50	25	41.7
50 +	35	58.3
Range	32- 60	
Mean \pm SD	48.77 \pm 9.00	
Median	50	
Gender:		
Male	18	30.0
Female	42	70.0
Marital status:		
Single	3	5.0
Married	46	76.7
Widow	6	10.0
Divorced	5	8.3
Residence:		
Urban	15	25.0
Rural	45	75.0
Education:		
Illiterate	31	51.7
Read and write	4	6.7
Basic	8	13.3
Intermediate	9	15.0
University	8	13.3
Job status:		
Retired	4	6.7
Free work	8	13.3
Housewife	38	63.3
Official	8	13.3
Worker	2	3.3

Table 2: Frequency and Percentage Distribution of Medical and Family History of Patients in the Study Sample (n=60).

Item	NO	%
Duration of DM(years):		
<5	9	15.0
5-10	25	41.7
>10	26	43.3
Range	2-23	
Mean ± SD	10.43±5.52	
Median	10.0	
Had family history of DM.	43	71.7
Degree of relativity:		
First degree	27	45.0
Second degree	20	33.3
Had DM complications.	60	100.0
Complications:		
Eye complications	46	76.7
Hypertension	45	75.0
Dental complications	45	75.0
Delayed wound healing	40	66.7
Neurological complications	31	51.6
Recurrent infections	29	48.3
Foot problems	25	41.7
Cardiac complications	17	28.3
Renal complications	16	26.7
Hepatic complications	14	23.3
Skin complications	10	16.7
Had hypoglycemic attack.	60	100.0
Causes of hypoglycemic attack:		
Excess medications	5	8.3
Delayed meal	45	75.0
Excess effort	29	48.3
Without causes	5	8.3
Had hyperglycemic attack.	60	100.0
Causes of hyperglycemic attack:		
Neglect medications	43	71.7
Fatty food	27	45.0
Excess candies	33	55.0
Psychological stress	48	80.0
Without causes	15	25.0
Had previous hospitalization for DM.	21	35.0
Frequency of previous hospitalization for DM:		
One time	13	21.7
Two times	2	3.3
Three times	6	10.0
Causes of previous hospitalization for DM:		
Hyperglycemia	20	33.3
Severe hypoglycemia	1	1.7
Diabetic ketoacidosis	0	0.0
Used medications		
Tablet	34	56.6
Insulin	13	21.7
Both	13	21.7
Body mass index (BMI)		
Normal	8	13.3
Overweight	17	28.3
Obese	35	58.4

Table 3: Mean Scores of Patients' Knowledge regarding DM in the Study Sample throughout the Study Phases (n=60).

Knowledge	Program phases			Wilcoxon Rank Test	
	Pre-test	Post-test	Follow-up test	Z1	Z2
	Mean±SD	Mean±SD	Mean±SD	(P-value)	(P-value)
- Overview of DM.	4.78±2.65	16.53±2.80	16.06±3.04	-6.752 (0.000**)	-6.747 (0.000**)
- Complications of DM.	10.05±6.27	34.15±5.85	33.28±6.81	-6.739 (0.000**)	-6.739 (0.000**)
- Diabetic dietary regimen.	0.40±0.67	7.95±2.25	7.38±2.51	-6.733 (0.000**)	-6.731 (0.000**)
- Physical exercises.	0.73±1.35	9.95±1.45	9.40±1.90	-6.778 (0.000**)	-6.764 (0.000**)
- Medications.	3.20±1.77	13.45±5.74	12.72±5.35	-6.756 (0.000**)	-6.749 (0.000**)
- Investigations.	1.12±0.37	5.81±0.59	5.60±0.96	-7.147 (0.000**)	-7.024 (0.000**)
- Hygienic care.	1.10±1.04	7.56±1.45	7.00±2.05	-6.781 (0.000**)	-6.765 (0.000**)
- Foot and nails care.	1.41±1.76	10.15±1.19	9.58±2.10	-6.762 (0.000**)	-6.758 (0.000**)
- Wound care	0.08±0.28	2.70±0.69	2.53±0.89	-7.105 (0.000**)	-6.846 (0.000**)
- Follow-up	1.32±0.65	3.10±0.51	3.05±0.56	-6.987 (0.000**)	-6.921 (0.000**)
Total DM knowledge	24.20±13.02	109.93±13.20	104.27±17.89	-6.737 (0.000**)	-6.635 (0.000**)

* P < 0.05 (significant) Z1: Pre/post Z2: Pre/ FU

Table 4: Mean Scores of Patients' Self-reported Practice regarding DM in the Study Sample throughout the Study Phases (n=60).

Self-reported practice	Program phases			Wilcoxon Rank Test	
	Pre-test	Post-test	Follow-up test	Z1	Z2
	Mean±SD	Mean±SD	Mean±SD	(P-value)	(P-value)
- Diabetic dietary regimen.	0.13±0.53	3.36±1.26	3.16±1.47	-6.713 (0.000**)	-6.598 (0.000**)
- Physical exercises.	0.12±0.25	1.70±2.14	1.45±2.09	-4.522 (0.000**)	-4.059 (0.000**)
- Drug therapy.	3.25±0.79	4.98±0.12	4.90±0.30	-6.862 (0.000**)	-6.889 (0.000**)
- Insulin self injection.	2.31±2.29	19.42±1.30	18.11±2.25	-4.526 (0.000**)	-4.476 (0.000**)
- Investigations.	1.60±1.68	21.50±2.41	20.58±3.18	-6.809 (0.000**)	-6.766 (0.000**)
- Hygienic care.	1.30±1.93	11.61±3.07	10.75±3.37	-6.750 (0.000**)	-6.750 (0.000**)
- Foot and nails care.	1.63±1.95	12.46±2.43	11.11±3.10	-6.775 (0.000**)	-6.763 (0.000**)
- Wound care.	0.95±0.65	3.55±0.85	3.30±0.92	-6.884 (0.000**)	-6.865 (0.000**)
- Follow-up.	0.80±0.60	2.58±1.75	2.55±1.77	-5.956 (0.000**)	-5.956 (0.000**)
- Management of complications.	1.40±0.96	6.41±1.89	6.13±1.89	-6.778 (0.000**)	-6.773 (0.000**)
Total DM self-reported practice	12.18±8.09	71.73±11.37	68.22±12.30	-6.739 (0.000**)	-6.613 (0.000**)

* P < 0.05 (significant) Z1: Pre/post Z2: Pre/ FU

Table 5: Adequacy of Self-Efficacy as Regards DM among Patients in the Study Sample throughout Study Phases (n=60).

Total patients' Self-efficacy	Pre		Post		Follow-up		Pre/Post		Pre/FU	
	No	%	No	%	No	%	Z1	P-value	Z2	P-value
Adequate	0	0.0	47	78.3	39	65.0	-	.000**	-	.000*
Inadequate	60	100.0	13	21.7	21	35.0	6.737		6.532	*

* P < 0.05 (significant) ** P < 0.01 (highly significant) Z1: Pre/post Z2: Pre/ FU

Table 6: Correlation Coefficient between Duration of Diabetes and Number of Present Complications among Studied Patients throughout the Program Phases (n= 60).

Item	Number of present complications	
	R	P-value
Duration of diabetes	0.853**	0.000

** P < 0.01 (highly significant)

Table 7: Correlation Coefficient between Patients' Knowledge, Self-reported Practice, and Self-Efficacy throughout the Study Phases (n=60).

Items	Knowledge		Self-reported practice		Self-efficacy	
	R	P-value	r	P-value	r	P-value
Pre Knowledge	1	0	0.428	0.001**	0.225	0.084
Pre self-reported practice	0.428	0.001**	1	0	0.687	0.000**
Pre Self-efficacy	0.225	0.084	0.687	0.000**	1	0
Post Knowledge	1	0	0.849	0.000**	0.800	0.000**
Post self-reported practice	0.849	0.000**	1	0	0.941	0.000**
Post Self-efficacy	0.800	0.000**	0.941	0.000**	1	0
FU Knowledge	1	0	0.840	0.000**	0.817	0.000**
FU self-reported practice	0.840	0.000**	1	0	0.944	0.000**
FU Self-efficacy	0.817	0.000**	0.944	0.000**	1	0

*r: Spearman correlation coefficient

* P < 0.05 (significant)

** P < 0.01 (highly significant)

* r: Weak correlation (0.1-0.24) Intermediate correlation (0.25-0.74)
Strong correlation (0.75-0.99).

DISCUSSION

Diabetes mellitus is now recognized as one of the most important public health challenges of the 21st century, affecting 415 million people, causing around 5 million deaths and accounting for 14.5% of all-cause mortality worldwide in 2015[18].

Management of diabetes greatly depends on the ability of the affected person to carry out self-care in his daily lives, and patient education is the corner stone to achieve this objective [19]. In addition to diabetes education; psychological factors such as SE are effective in helping diabetic patients show behavioral changes in terms of treatment process. SE is essential for motivating patients in treatment of T2DM as well as it is thought to be associated with better self-management practice, glycemic control, and functional sufficiency in ensuring diabetes control[20].

Discussion of the results will cover these areas in the following sequence; demographic characteristics of the studied patients; medical and family history of the studied patients; patients' knowledge regarding DM; patients' self-reported practice regarding DM; patients' self-efficacy; and correlations coefficient between different variables.

Regarding demographic characteristics, results of the present study revealed that the age of the studied patients ranged from 32-60 years old with median 50 years old which is the age with highest prevalence of T2DM as reported by Ryden [21]. This may related to T2DM occurs most commonly in people older than 30 years old. Related to gender, more than two thirds of patients were female. This finding was expected due to females are at higher risk of developing DM. This result was in congruent with that of Wang et al., [22] who found that about two thirds of the study sample was female. As for marital status, more three quarters of patients were

married. This finding was supported in Pakistan by Akbar et al., [23] who reported that more three quarters of studied patients were married.

Regarding the educational level, more than one half of studied patients in the study group were illiterate. This finding might be due to that the majority of participants from rural areas, where the illiteracy was still high. This result agreed with the study conducted by Khan et al., [24] who clarified that two thirds of diabetic patients in the study were illiterate. Concerning residence, three quarters of the studied patients were from rural areas while one quarter was from urban areas. In my opinion this may related to that Al-Ahrar Hospital serve all surrounding villages and hamlets, therefore most of the patients from the rural. This finding agreed with Koley [25] who pointed that more than half of studied patients were from rural areas. As regards job status, less than two thirds of studied patients were housewives. This finding may be due to that most of studied patients were female. This study was in agreement with Saleh et al., [26] who clarified that that nearly half of the studied patients were housewives.

As regards duration of diabetes, the present study revealed that more than two fifths of studied patients had diabetes for more than ten years. This may be due to chronicity of the disease. This long disease duration could explain the relatively high prevalence of diabetes mellitus-related complications among studied patients. This finding was in agreement with Lee, Lee, & Moon [27] who mentioned that more than half of studied patients had diabetes for more than ten years.

According to the present study, majority of studied patients' total knowledge was unsatisfactory at the pretest. The finding is alarming since the lack of information has negative repercussions on patient's outcomes. These deficiencies could be due to that health care providers don't give due

importance to health education of diabetic patients, low level of education among studied patients, and large number of diabetic patients admitted to clinic daily. This finding was in congruent with that of Islam et al., [28] who mentioned low level of knowledge among diabetic patients.

After educational program implementation, statistically significant improvements were shown in patients' knowledge regarding all aspects of DM compared to pre-program and these persisted in follow-up phase with slight decline. These findings indicated success of the educational program which can be attributed to two reasons. First, educational booklet content, which was based on patients' needs, as well as its process where adult learning methods with active participation was used. Second, verbal instructional information. This finding agreed with Figueira et al., [29] who found that the educational interventions have positively contributed to the participants' knowledge about diabetes mellitus, the medication treatment adherence and the glycated hemoglobin rates. Also in line with the current study results, Varma [30] who found that educational intervention was highly effective in improving diabetic patients' knowledge as it significantly increased from baseline to posttest after the completion of the second follow up educational sessions.

The present study revealed obviously inadequate self-reported practice before implementation of educational program. This was quite expected given the mostly low educational level of patients, lack of knowledge, and lack of training in diabetes related skills which is an essential role of physicians and nurses in management of diabetes. The consequences of such deficient practices were evident in the finding that all studied patients had T2DM complications. This finding was consistent with Musenge et al., [31] in study at

Lusaka, Zambia who demonstrated low level of self management activities as regards diabetes among studied patients.

After educational program implementation, statistically significant improvements were shown in patients' self-reported practice related to all aspects of DM compared to pre-program and these persisted in follow-up phase with slight decline. These findings indicated success of the educational program. A similar success of a nursing intervention in enhancing T2DM patients' self-management was reported in a study in Korea by Jung et al., [32] which concluded that promoting personal motivation and self-efficacy could result in better health outcomes. This finding was in the same line with Zareban, Niknami, & Rakhshani [33] in study in Zahedan, Iran about the effect of self-efficacy education program on reducing blood sugar levels in patients with Type 2 diabetes who assumed that self-efficacy training program improves attitude and self care behaviors performance of the studied patients. The training increases learners' active participation in caring themselves, because they have experienced the results of the training program and they are motivated to enhance their better self-care behaviors. According to the present study, none of the studied patients had adequate self-efficacy in pre program phase. This deficiency could be attributed low educational level of studied patients, in addition to lack of patients' knowledge and practice as regards DM. In congruence with this current study finding, a study in the Netherlands by Van der Wulp et al., [34] demonstrated low levels of self-efficacy among T2DM patients.

After educational program implementation, statistically significant improvements were shown in patients' self-efficacy and these persisted in follow-up phase with slight decline. This finding was supported by Moein et al., [35] in

study at Iran about Effect of an Empowerment Program on Self-Efficacy of Patients with Type 2 Diabetes who stated that using an empowerment program had statistical significant positive effects on self-efficacy in patients with type 2 diabetes. Moreover, Mohamadinejad et al., [36] in study at Iran about effect of patient education program on self-efficacy in patients with diabetes. Results revealed that patient education program led to a considerable improvement of self-efficacy in patients with T2DM of study group in comparison to the patients in the control group.

The result of the present study indicated that there was a strong positive highly statistically significant correlation between patients' duration of diabetes and their number of present complications. This means that the longer duration of diabetes, the more complications occurrence. This result was in accordance with Ehrmann et al., [37] who revealed that diabetic patients in the randomized controlled trial who had significant longer diabetes duration had a greater number of diabetes complications and lower self-efficacy scores. This result agreed with Kavitha & Aruna [38] who detected that longer duration of diabetes development associated with development and progression of chronic complications in diabetes.

The present study revealed intermediate a highly statistically significant correlation between patients' knowledge, practice and self-efficacy in post program phase. However, in relation to follow up program phase, the current study delineated intermediate a highly statistically significant correlation between patients' knowledge, practice and self-efficacy in follow up program phase and versus. The finding of the study consistent with Taha, Zaton & Abd Elaziz [39] who found significant and positive correlations between patients' self-efficacy score and

their educational level and knowledge score.

Finally, the results of this study supported all hypotheses where there were an improvement in patients' knowledge, self-reported practice, and self-efficacy in relation to DM. Moreover, the finding of the current study concluded that promoting personal motivation and self-efficacy could result in better health outcomes. This emphasize the importance of good patient information about the illness in addition to increased patients' participation, self confidence in making choices and decisions regarding the management of their disease, and of intensifying patients' efficacy and belief in future change.

REFERENCES

- 1- World Health Organization. 2017: Diabetes Fact Sheet. Retrieved from <http://www.who.int/mediacentre/factsheets/fs138/en/>. Accessed on 6/5/ 2017 at 7 pm.
- 2- International Diabetes Federation. (2013): Diabetes Atlas. 6th ed. Retrieved from https://www.idf.org/sites/default/files/EN_6E_Atlas_Full_pdf. Accessed on 11/9/2015 at 6 pm.
- 3- Gangawane AK, Bhatt B, and Sunmeet M. (2016): Skin Infections in Diabetes: A Review. *Journal of Diabetes and Metabolism*, 7 (2):644.
- 4- Rajpathak SN and Wylie-Rosett J. (2011): High Prevalence of Diabetes and Impaired Fasting Glucose among Chinese Immigrants in New York City. *Journal of Immigrant and Minority Health*; 13(1):181-183.
- 5- Quinn CC, Khokhar B, Weed K, Barr E, and Gruber-Baldini AL. (2015): Older Adult Self-Efficacy Study of Mobile Phone Diabetes Management. *Diabetes Technology and Therapeutics Journal*; 17(7):455-461.

-
- 6- Martinez Y, Campbell SM, Hann M, and Bower P. (2014): The relationship between quality of care and self-management in patients with type 2 diabetes: a cross-sectional survey in primary care in Mexico. *Quality in Primary Care Journal*; 22(6):262-269.
 - 7- Reisi M, Mostafavi F, Javadzade H, Mahaki B, Tavassoli E, and Sharifirad G. (2016): Impact of Health Literacy, Self-efficacy, and Outcome Expectations. *Oman Med J*; 31(1): 52–59.
 - 8- Montague MC, Nicols SA, & Dutta AP. (2005). Self management in African American women with diabetes. *Diabetes Educator*, 31(4): 700-711.
 - 9- Poretsky L. (2013): Principles of diabetes mellitus. 5th Ed. New York, Springer Science Business Media, LLC. pp: 281-400.
 - 10- Abdel-Razik BG. (2012): Effect of an Educational Program on Self-efficacy for Patients with Type 2 Diabetes Mellitus. Unpublished Doctorate Thesis. Faculty of Nursing, Banha University, Egypt. Pp 118-128.
 - 11- Brownlee M, Aiello LP, Cooper M, Vinik AI, Nesto RW, and Boulton AJ. (2011): Complications of Diabetes Mellitus. In Williams textbook of endocrinology. 12th Ed, Philadelphia, Saunders. pp: 1462-1551.
 - 12- Rosdahl C, Bunker M, and Kowqlski T. (2011): Textbook of Basic Nursing. 10th Ed. Philadelphia, Lippincott Williams & Wilkins. pp: 869-853.
 - 13- Schmitt A, Gahr A, and Hermanns N. (2013): The Diabetes Self-Management Questionnaire (DSMQ): development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. *Health and Quality of Life Outcomes*; 11(1): 138.
 - 14- Girouard RM. (2012): Nurses' Guide to Teaching Diabetes Self-Management. 2nd Ed. New York, Springer Publishing Company, LLC. P: 71-113.
 - 15- Salzman B, Collins L, and Hajjar ER. (2012): Chronic disease management, Primary care clinics in Office Practice. 1st Ed. Saunders. P.324.
 - 16- Weinger K, and Carver CA. (2010): Educating Your Patient with Diabetes. 2nd ed., New York: Humana Press; Press, a part of Springer Science.Business Media, LLC.pp 289–307.
 - 17- Van der Bijl J, Van Poelgeest-Eeltink A, & Shortridge-Baggett LM. (1999): The psychometric properties of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus. *Journal of Advanced Nursing*; 30(2), pp: 352-359.
 - 18- International Diabetes Federation. (2015): IDF Diabetes Atlas, 7th ed, IDF, Brussels, Belgium. Retrieved from <http://www.diabetesatlas.org/>. Accessed on 3/5/2016 at 11 pm.
 - 19- Bayat F, Shojaeezadeh D, Baikpour M, Heshmat R, Baikpour M, and Hosseini M. (2013): The effects of education based on extended health belief model in type 2 diabetic patients: a randomized controlled trial. *Journal of Diabetes & Metabolic Disorders*;12(1):45.
 - 20- Cosansu G and Erdogan S. (2014): Influence of Psychosocial Factors on Self-Care Behaviors and Glycemic Control in Turkish Patients With Type 2 Diabetes Mellitus. *Journal of Transcultural Nursing*; 25(1) 51–59.
 - 21- Ryden I. (2014): ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD-summary, *Diab Vasc Dis Res*; 11(3):133:173.
 - 22- Wang HF, Chen YC, Yang FH, and Juan JC. (2017): Relationship between Type 2 Diabetes Self-Efficacy and Quality of Life: Analysis Under
-

- Varying Glycated Hemoglobin Conditions. *Family Medicine & Medical Science Research*; 6(1):2.
- 23- Akbar N, Aqeel T, Ul-Haq N, Naseem A, and Dhingra S. (2015): Assessment of Knowledge and Dietary Misconceptions among Diabetic Patients. *Journal of Pharmacy Practice and Community Medicine*; 2(1):9-15.
- 24- Khan M, Zeb A, Wahab F, Khan MT, Nawaz A, and lamFaraz N.(2017): Knowledge Attitude and Practice of Diet and Exercise among Diabetic Patients for Normal Plasma Glucose Level. *International Journal of Scientific and Research Publications*; 7(1):2250-3153.
- 25- Koley (2016): Knowledge, Attitude, and Practice Related to Diabetes Mellitus Among Diabetics and Nondiabetics Visiting Homeopathic Hospitals in West Bengal, India. *J Evid Based Complementary Altern Med.*; 21(1):39-47.
- 26- Saleh F, Afnan F, Ara F, Mumu S J, and Khan A A. (2017): Diabetes Education, Knowledge Improvement, Attitudes and Self-Care Activities Among Patients With Type 2 Diabetes in Bangladesh, Jundishapur J Helath Sci.; 9(1): e36058.
- 27- Lee EH, Lee YW, and Moon SH. (2016): A Structural Equation Model Linking Health Literacy to Self-efficacy, Self-care Activities, and Health-related Quality of Life in Patients with Type 2 Diabetes. *Asian Nursing Research*; 10(1):82-87.
- 28- Islam FM, Chakrabarti R, Dirani M, Islam MT, Ormsby G, Wahab M, Critchley C, and Finger RP. (2014): Knowledge, attitudes and practice of diabetes in rural Bangladesh: the Bangladesh Population based Diabetes and Eye Study (BPDES). *PLoS One* ; 9(10):e110368.
- 29- Figueira ALG, Gomes-Villas Boas LC, Coelho ACM, Foss-Freitas MC, and Pace AE. (2017): Educational interventions for knowledge on the disease, treatment adherence and control of diabetes mellitus. *Rev. Latino-Am. Enfermagem J*; 25(1).e2863.
- 30- Varma M. (2016): Effects of Diabetic Education on Body Mass Index, Fasting Blood Sugar and Knowledge Gained by Diabetic Patients in Central Hospital Nampula, *International Journal of Diabetes Research*; 5(5):102-121.
- 31- Musenge EM, Michelo C, Mudenda B, and Manankov A. (2016): Glycaemic Control and Associated Self-Management Behaviours in Diabetic Outpatients: A Hospital Based Observation Study in Lusaka, Zambia. *Journal of Diabetes Research*. Volume 2016, Article ID 7934654; p.9.
- 32- Jung SY, Lee SJ, Kim SH, & Jung KM. (2015): A predictive model of health outcomes for young people with type 2 diabetes. *Asian Nurs Res (Korean Soc Nurs Sci)*. 2015 Mar; 9(1): 73-80.
- 33- Zareban I, Niknami S, & Rakhshani F. (2013): The effect of self-efficacy education program on reducing blood sugar levels in patients with Type 2 diabetes. *Health Education & Health Promotion*; 1(1):67- 79.
- 34- Van der Wulp I, de Leeuw JR, Gorter KJ, & Rutten GE. (2012): Effectiveness of peer-led self-management coaching for patients recently diagnosed with Type 2 diabetes mellitus in primary care: a randomized controlled trial. *Diabet Med.*; 29(10): e390-7.
- 35- Moein, M & Aghajani, M & Ajorpaz, N & Khorasanifar, L. (2016): Effect of an Empowerment Program on Self-Efficacy of Patients with Type 2 Diabetes. *Iranian Red Crescent Medical Journal*. inpress. 58(10); 114-132.
- 36- Mohamadinejad F, Pedram Razi S, Aliasgharpour M, Tabari F, Kazemnejad A. (2015): Effect of

- patient education program on self-efficacy in patients with diabetes. Iranian Journal of Nursing Research.; Vol. 10, Issue 36, No 1:35-41.
- 37- Ehrmann D, Bergis-Jurgan N, Haak T, Kulzer B, and Hermanns N. (2016): Comparison of the Efficacy of a Diabetes Education Programme for Type 1 Diabetes (PRIMAS) in a Randomised Controlled Trial Setting and the Effectiveness in a Routine Care Setting: Results of a Comparative Effectiveness Study. PLoS ONE ;11(1): e0147581.
- 38- Kavitha M and Aruna S. (2014): Knowledge on complications of diabetes mellitus among patients with diabetes mellitus – a descriptive study. International Journal Comprehensive Nursing; 1(1):18–20.
- 39- Taha NM, Zaton HK & Abd Elaziz NA. (2016): Impact of health educational guidelines on the knowledge, self-management practice and self-efficacy of patients with type-2 diabetes. Journal of Nursing Education and Practice; 6 (9), 46-49.