



Contents lists available at ScienceDirect

Saudi Journal of Biological Sciences

journal homepage: [www.sciencedirect.com](http://www.sciencedirect.com)

Original article

# Evaluating the effect of health education program on outcomes of type I diabetic patients: A randomized controlled study

Sahar A. Abd-El mohsen<sup>a,\*</sup>, Azhar A. Mohamed Shehata<sup>a,b</sup><sup>a</sup> Department of Nursing Sciences, College of Applied Medical Sciences in Wadi Alldawasir, Prince Sattam bin Abdulaziz University, Postal code: 18616, Saudi Arabia<sup>b</sup> Department of Community Health Nursing, Faculty of Nursing, Zagazig University, Egypt

## ARTICLE INFO

## Article history:

Received 5 November 2019

Revised 6 September 2020

Accepted 7 September 2020

Available online 14 September 2020

## Keywords:

Health education program

Outcome

Type I diabetic patient

## ABSTRACT

Background; findings from the meta-analysis have shown that patients present improvements in glycaemic control, and in the prevention and control of the acute and chronic complications, when they receive effective treatment, self-management support and regular monitoring. The present study aimed to evaluate the effect of implementing a health education program on outcomes of type I diabetic patients. Quasi-experimental study design was used to fulfill the aim of the study. The study was conducted in the outpatient diabetic clinic at Asyut University Hospital; 60 adult male and female patients who attended the outpatient diabetic clinic were included. Two tools were used in this study; structured interviewing questionnaire with three parts; part one: demographic patient variables, part two: patient's medical data and part three: patient's knowledge regarding diabetes, the second tool is evaluation of type I diabetic patients' outcomes (pre/post). Results revealed that the highest percentage of the studied samples were in the age group 18 to less than 30 years, 90.0% of the study group and 83.4% of the control group were having a family history of diabetes, a statistically significant difference was found in the study group patients pre and post application of the program regarding insulin injection and glycaemic control. Conclusion: this study demonstrated the effectiveness of health education program implementation on the outcomes of type I diabetic patients in terms of improved knowledge and practicing exercise, teeth care, feet care and on glycaemic control.

© 2020 The Author(s). Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

One of the most common autoimmune diseases is insulin-dependent diabetes mellitus (IDDM) or diabetes mellitus type I, with a prevalence of about 200 per 100,000 (Betterle et al., 2002; WHO, 2006). It is a disorder in which the insulin-producing B-cells of the islets of Langerhans in the pancreas are attacked by the immune system, eventually resulting in insulin deficiency and hyperglycemia (Atkinson & Eisenbarth, 2001; WHO, 2006).

In the year 2000, the prevalence of diabetes was 2.8%, with an estimated increase up to 4.4% in 2030; that means increase from 171 million to 366 million (Wild et al., 2004). The prevalence of

diabetes in Egypt is estimated to be 16.2% (WHO, 2016), and diabetes prevalence will continue to rise (Shaw et al., 2010).

The development of nursing strategies to increase diabetic patients' self-care behavior is considered a very important issue as the level of self-care is still so low. Diabetic patients can face a diversity of problematic situations, which make it difficult for them to do self-care during the long duration of the disease (Lee, & Choe, 2016).

Providing program models in health care is important to assist the patient in decision making and taking responsibility for their health care in controlling the disease and preventing its chronic complications (Utz et al., 2008; Gimenes et al., 2009).

One of the strategies that can help reduce the high prevalence of diabetes complications is health education (Funnell et al., 2008). Educating patients with DM may play a key role through encouraging those patients to take responsibility for and supporting them in the day to day control of their condition (Davies et al., 2008). Studies from all over the world have shown the positive effects of the educational process on diabetes, findings from the meta-analysis have shown that patients present improvements in glycaemic control, and in the prevention and control of the acute and chronic

\* Corresponding author.

E-mail address: [sah.ahmed@psau.edu.sa](mailto:sah.ahmed@psau.edu.sa) (S.A. Abd-El mohsen).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

complications, when they receive effective treatment, self-management support and regular monitoring (Jarvis et al., 2010).

## 2. Aim of the study

To evaluate the effect of implementing a health education program on outcomes of type I diabetic patients.

## 3. Research hypothesis

Outcomes of type I diabetic patients who will be exposed to the health education program (study group) will be better than those who will not receive the program (the control group).

## 4. Patients and methods

### 4.1. Research design

Quasi-experimental study design was used to fulfill the aim of the study.

### 4.2. Setting

The study was conducted in the outpatient diabetic clinic at Asyut University Hospital.

### 4.3. Sample

60 adult male and female patients who attended the outpatient diabetic clinic were included with the following criteria; age between 18 to 65 years, insulin dependent diabetics (type I diabetes), able to comprehend and not having any intellectual, visual, auditory or fine motor disorders. Patients were randomly assigned into two equal groups (study and control) 30 patients for each. The study group received the health education program, while the control group received routine hospital instructions.

**Method of randomization:** patients meeting the inclusion criteria and attending the clinic days of odd month days (e.g. 1st, 3rd, 5th ...etc.) were included in the control group and those attending the clinic in even month days (2nd, 4th, 6th... etc.) were included in the study group, till completion of the study sample.

**Tools:** Two tools were used in this study:

(I) Structured interviewing questionnaire:

Developed by the researchers after extensive literature review and it included three parts:

*Part one: Demographic patient variables* (age, sex, marital status, and educational level).

*Part two: Patient's medical data:*

This part was used to assess the following: family history of diabetes, duration of diabetes and source of knowledge regarding diabetes.

*Part three: Patient's knowledge regarding diabetes:*

This part was used to assess patient's knowledge of diabetes as definition, clinical manifestations, management and complications.

(II) Evaluation of type I diabetic patients' outcomes (pre/post):

(A) The study group patient's knowledge regarding feet care

- The correct way of cutting toe nails
- Drying between toes

- If feet care is provided and by whom (the patient or a family member)
- (B) The study group patient's knowledge regarding teeth care
  - If teeth care is done
  - Frequency of teeth care provided
  - Dentist visits
- (C) The study group patient's knowledge regarding exercise
  - If the patient is practicing exercise or not
  - Benefits of exercise
- (D) Insulin injection practices by the patient
  - Insulin preparation
  - Insulin injection
  - Sites of insulin injection
  - Rotation methods of injection sites
- (E) Assessment of the studied samples (control and study) blood glucose level

### 4.4. The health education program for type I diabetics

The program was prepared by the researchers after assessing the needs of the sample, the content evolved around knowledge and best practices for type I diabetes care. It included knowledge about definition of diabetes, causes, diet, the importance of regular monitoring of blood glucose level and complications of diabetes treatment (eye complications, urinary complications and feet complications). Feet care; importance, how to test temperature of water before immersing feet in, not walking bare feet, wearing socks, the use of new shoes for short periods of time when it is new, cutting the nails straight, inspecting the soles daily using a mirror or by one of the family members. Exercise; benefits, types of exercise allowed especially walking, the use of soft and comfortable shoes for practicing exercise. And Insulin preparation, sites of insulin injection, methods of rotating the sites of injection and how to self-administer the injection. Teaching materials were selected to suit the educational level and level of understanding for all patients.

**Implementation of the program:** the health education program was implemented through five sessions, each of about 45 min, two sessions for theory (definition, clinical manifestations and complications of diabetes) and three sessions for the practical part (insulin injection, foot care, exercise and teeth care), these sessions were provided based on small group teaching "the study group patients were divided into five groups (6 patients each)".

**Teaching methods used:**

- Lecture
- Group discussion
- Media:**
- Videos
- Posters
- Handbook

**Evaluation of the program:** it was done two months after implementation of the program.

## 5. Methods

### (1) Administrative approval:

Official administration permission was obtained from the director of the outpatient clinics after the aim of the study and the program were explained to him.

### (2) Tools development:

Tools 1, and 2 were developed after reviewing of related literature.

**Tool validity and reliability:**

Tool validity was established by a panel of 5 experts (3 medical-surgical nursing professors and 2 dermatology professors) from Asyut University. They reviewed the tool for clarity, relevance, comprehensiveness, understanding, and applicability. Tool reliability refers to the degree of consistency with which the questionnaire measures the thing it is supposed.

**Ethical considerations:**

This study was approved by faculty of nursing ethics committee, an informed consent was obtained from patients to participate in the study after the nature and purpose of the study were explained to them. Patients were assured that the collected data will be absolutely confidential and that their participation is voluntary and they can withdraw at any time of the study.

**(3) Pilot study:**

A pilot study was conducted on six patients during January 2019 in order to test the clarity and applicability of the tools. Those patients who were involved in the pilot study were included in the main study as there were no modifications required.

**(4) Data collection:**

- The data collected over a period of 6 months starting from May 2019 till the end of June 2019.

**6. Analysis of the results**

Data was analyzed using the computer program SPSS“ version 19” Chicago, USA. The tests used were Chi-Square, mean & standard deviation, Paired *t*-test. For all statistical tests, the significance level was set at  $P \leq 0.05$ .

**7. Results**

Table 1 reveals that regarding age group the highest percentage of the studied samples were in the age group 18 to less than 30 years (63.4% and 50.0%) followed by the group 40 to less than 50 years (30.0% and 33.3%) in the study and control group respectively. For Sex: female represented 60.0% of the study group and 53.4% of the control group. Regarding Marital status; the highest percentage in both groups were Married (93.3% of the study group

and 66.7% of the control group. And finally regarding educational level; the highest percentages in both groups were secondarily educated 30.0% in the study group and 26.6% of the control group, with no statistically significant difference in any of the demographic patient variables of both groups.

Table 2 reveals that 90.0% of the study group and 83.4% of the control group were having a family history of diabetes. Regarding duration of diabetes; 53.3% of the study group and 63.3% of the control group had diabetes for 15 years and more, while an equal percent of both the study and control groups (36.7%) had diabetes for 10 to less than 15 years, and for patient’s source of knowledge regarding diabetes; 56.6% and 53.4% got their knowledge from a health care member and 33.4%, 26.6 from a relative in both the study and control group patients respectively with no statistically significant differences between both groups in any of the medical history items.

Table 3 reveals that there was no statistically significant difference between pre and post program implementation in the control group (*p* value of the control group) and between pre-program implementation among the study and control groups (*P1* value) in the following items; patient’s knowledge regarding definition of diabetes, clinical manifestations of diabetes, diabetic complications, eye complications, urinary complications, or feet complications while there was a statistically significant difference between the study group patients pre and post application of the program and between post application of the program between the study and control group patients (*P2* value).

Fig. 1 reveals significant improvement in level of the study group patient’s knowledge regarding correct way of cutting toes nails (70% pre compared to 30% post), drying between toes (35% pre and 95% post), 90% cared for their feet by themselves post application of the program and 20% of the sample does not care for their feet pre compared to 5% post application of the program.

Fig. 2 illustrates that regarding teeth care; 50% used to care for teeth pre compared to 95% post, 35% cared for their teeth three times daily post program compared to only 10% caring for three times daily pre-program, 70% regularly will visit their dentist post program while only 10% were regularly visiting their dentist pre application of the program.

Fig. 3 illustrates that (93%) of patients in the study group were practicing exercises post application of the program compared to only 30% pre-program implementation, 40% of them knew the ben-

**Table 1**  
Distribution of the studied patients regarding socio-demographic characteristics (n = 60).

Variable	Study (n = 30)		Control (n = 30)		P value
	No.	%	No.	%	
<b>Age:</b>					0.31
18 to less than 30 years	19	63.4	15	50.0	
30 to less than 40 years	1	3.3	4	13.3	
40 to less than 50 years	9	30.0	10	33.3	
50 years and above	1	3.3	1	3.3	
<b>Sex:</b>					0.11
Male	12	40.0	14	46.6	
Female	18	60.0	16	53.4	
<b>Marital status:</b>					0.91
Single	1	3.3	1	3.3	
Married	28	93.3	20	66.7	
Divorced	0	0.0	3	10.0	
Widowed	1	3.3	6	20.0	
<b>Educational level:</b>					0.16
Illiterate	6	20.0	7	23.4	
Primary	2	6.7	3	10.0	
Preparatory	6	20.0	7	23.4	
Secondary	9	30.0	8	26.6	
University	7	23.3	5	16.6	

**Table 2**  
Distribution of the studied sample according to medical history (n = 60).

Variable	Study (n = 30)		Control (n = 30)		P-value
	No.	%	No.	%	
<b>Family history of diabetes:</b>					
Yes	27	90.0	25	83.4	0.236
No	3	10.0	5	16.6	
<b>Duration of diabetes:</b>					
Less than 5 years	2	6.7	0	0.0	0.121
5 to less than 10 years	1	3.3	0	0.0	
10 to less than 15 years	11	36.7	11	36.7	
15 years and more	16	53.3	19	63.3	
<b>Source of knowledge regarding diabetes:</b>					
Health care member	17	56.6	16	53.4	0.470
Relative	10	33.4	8	26.6	
Mass media	3	10.0	6	20.0	

**Table 3**  
Distribution of the studied sample according to their knowledge about diabetes and its complications throughout the program (n = 60).

Variable	Control (n = 30)				Study (n = 30)				P1-value	P2-value
	Pre test		Post test		Pre test		Post test			
	No.	%	No.	%	No.	%	No.	%		
<b>Definition of diabetes:</b>										
Complete correct answer	2	6.6	2	6.6	1	3.3	27	90.0	1.000	0.001
Incomplete correct answer	10	33.4	11	36.7	12	40.0	2	6.6		
Wrong answer or don't know	18	60.0	17	56.7	17	56.7	1	3.3		
<b>P-value</b>	0.71				0.001					
<b>Clinical manifestations of diabetes:</b>										
Complete correct answer	1	3.3	3	10.0	2	6.6	29	96.7	1.000	0.001
Incomplete correct answer	9	30.0	17	56.7	13	43.4	1	3.3		
Wrong answer or don't know	20	66.7	10	33.3	15	50.0	0	0.0		
<b>P-value</b>	1.000				0.002					
<b>Diabetic complications:</b>										
Known	13	43.3	14	46.6	12	40.0	28	93.4	0.34	0.001
Not known	17	56.7	16	53.4	18	60.0	2	6.6		
<b>P-value</b>	1.000				0.001					
<b>Eye complications:</b>										
Complete correct answer	3	10.0	4	13.4	2	6.6	25	83.4	0.92	0.001
Incomplete correct answer	12	40.0	12	40.0	10	33.3	3	10.0		
Wrong answer or don't know	15	50.0	14	46.6	18	60.0	2	6.6		
<b>P-value</b>	0.76				0.001					
<b>Urinary complications:</b>										
Complete correct answer	3	10.0	3	10.0	1	3.3	27	90.0	0.77	0.01
Incomplete correct answer	12	40.0	12	40.0	12	40.0	2	6.6		
Wrong answer or don't know	15	50.0	15	50.0	17	56.7	1	3.3		
<b>P-value</b>	0.78				0.002					
<b>Feet complications:</b>										
Complete correct answer	0	0.0	3	10.0	2	6.6	28	93.4	0.28	0.000
Incomplete correct answer	6	20.0	9	30.0	10	33.4	2	6.6		
Wrong answer or don't know	24	80.0	18	60.0	18	60.0	0	0.0		
<b>P-value</b>	0.77				0.000					

**N.B.:** **P** = difference between same group pre and post, **P1** = difference between control and study groups pre, **P2** = difference between control and study groups post, statistically significant  $P < 0.05$ ).

efits of practicing exercise compared to 10% pre implementation of the program, with a statistically significant difference between pre and post application of the program.

Fig. 4 reveals a statistically significant difference in the study group patients pre and post application of the program regarding the following insulin preparation (20% pre, 90% post), insulin injection (20% pre, 90% post), knowing different sites of insulin injection (5% pre, 98% post), and rotating injection sites (10% pre and 98% post).

Table 4 demonstrates that there was no statistically significant difference between the study and control group patients regarding their blood glucose level pre application of the program while there was a highly statistically significant difference between the

study and control group patients post implementation of the program and between the study group patients pre and post implementation of the program.

## 8. Discussion

Educating diabetic patients on their self-care and improving their knowledge regarding the disease and prevention of its complications is a process with several challenges and has to be faced by all health care members (Ferguson et al., 2015; Mansyur et al., 2015; Rushakoff et al., 2014; Watts et al., 2016). Giving diabetic patients the co-responsibility for their care following the educational process allows them to become aware of their care, and be

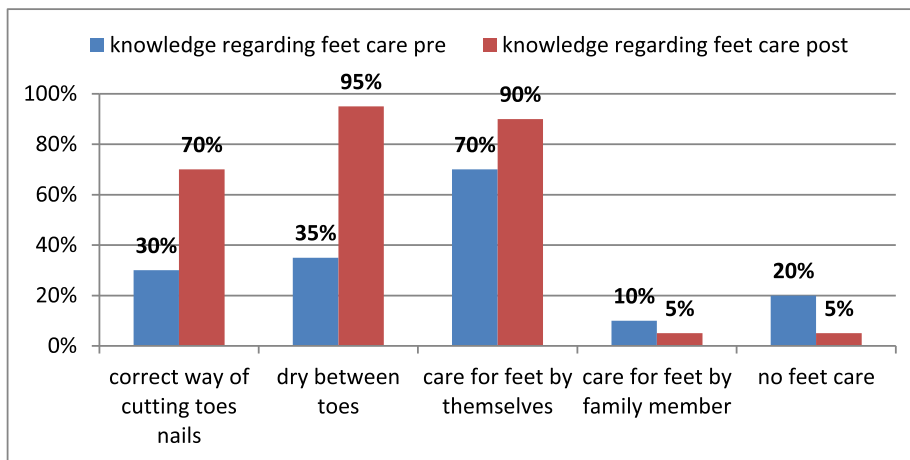


Fig. 1. Distribution of the study group according to their knowledge regarding foot care pre and post application of the program (n = 30).

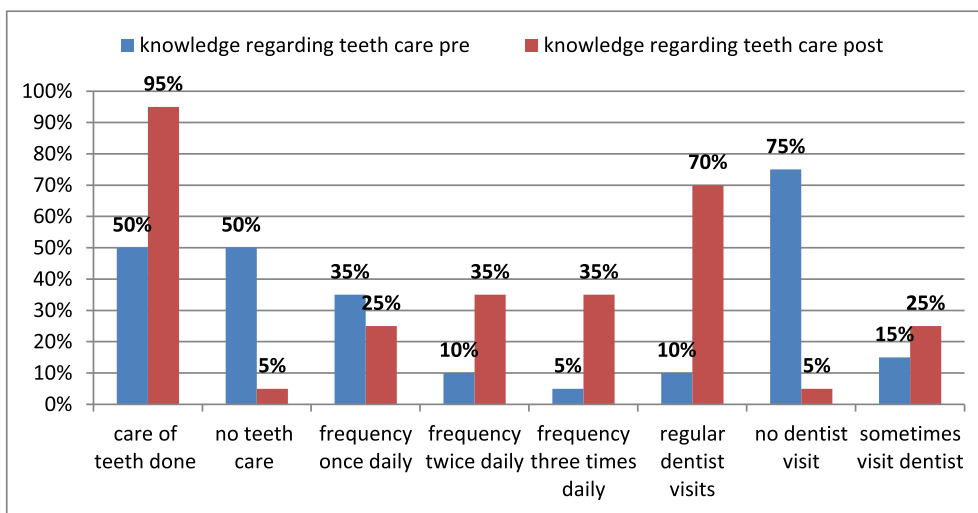


Fig. 2. Distribution of the study group according to their knowledge regarding teeth care pre and post application of the program (n = 30).

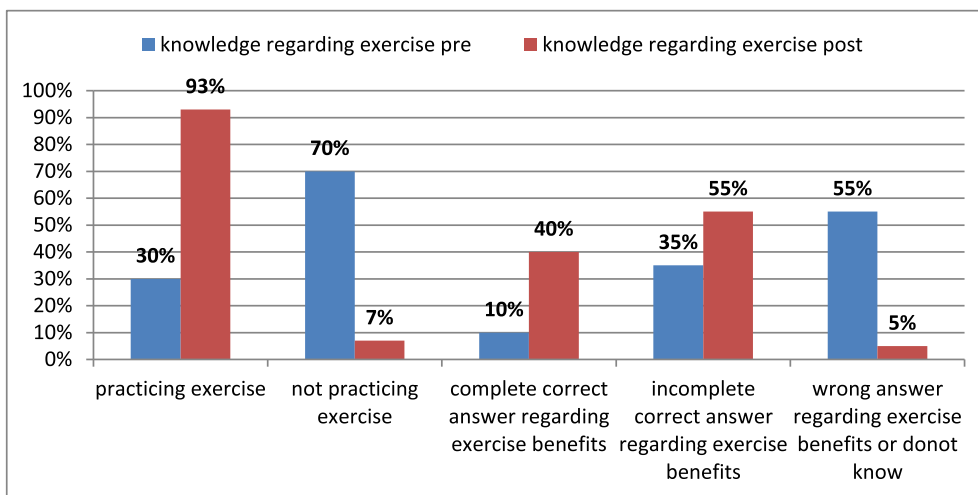
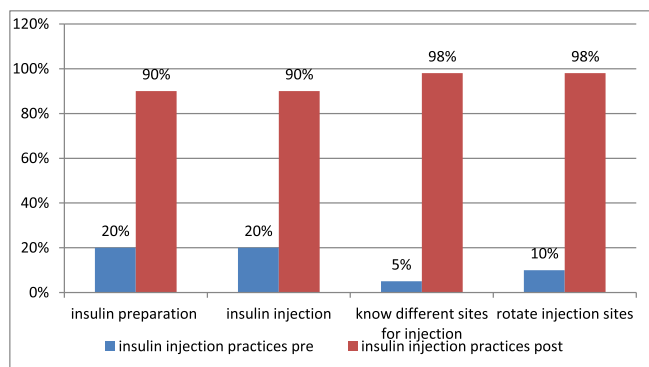


Fig. 3. Distribution of the study group according to their knowledge regarding exercise pre and post application of the program (n = 30).



**Fig. 4.** Distribution of the study group regarding insulin injection practices pre and post application of the program (n = 30).

responsible for their actions, this process leads the patient to reflect on his / her practice of care, allowing them to make their own choices (Gautam et al., 2015; Kuijpers et al., 2013).

The results of the present study revealed that regarding age group the highest percentage of the studied samples were in the age group 18 to less than 30 years, female, married and secondarily educated. This study result does not agree with the result of AL-Shahrani, 2018 regarding age group that in his study the highest percentage (68.8%) was older than 45 years of age, while it comes in agreement with the same study results regarding gender as (57.4%) of his sample were female and married (86.9%). Torres et al., 2018 also agrees with the female predominance as in their study female represented (69.0%) of the control group and (74.7%) of the study group. Sung et al. (2016) strongly agree with the current study results as their results revealed that the highest percentages in their studied samples were married; (76.47%) of the intervention group and (65.71%) of the control group. Regarding educational level the current study result coincides with McEwen et al., 2015 who reported that the highest percentage in their study 171 (38%) were high school graduates.

The present study revealed that the majority of the studied patients were having a family history of diabetes. Regarding duration of diabetes; the highest percentage in both groups had diabetes for 15 years and more and their source of knowledge regarding diabetes was a health care member. Torres et al., 2018 have come to the same conclusion regarding duration of diabetes in years as the mean ± standard deviation was 9.9 ± 8.5 in the intervention group and 11.12 ± 4.16 in the control group.

The results of the current study illustrated a great improvement in both knowledge and practice of the studied patients regarding diabetes and self-care measures. Also a significant improvement in patients' blood glucose level either between the study and control group patients post implementation of the educational program or between the study group patients themselves pre and post application of the program.

**Table 4**

Mean and standard deviation for blood glucose level of the studied samples pre and post application of the program (n = 60).

Variable	Control (n = 30)		Study (n = 30)		P1-value	P2-value
	Pre test	Post test	Pre test	Post test		
Fasting blood glucose level	250 ± 43.3	250.2 ± 45.1	325.5 ± 55.4	225 ± 40.7	0.15	0.000
P-value	0.33	0.000				
2hr. post prandial blood glucose level	347 ± 62.3	323.2 ± 58.4	337.1 ± 50.6	325 ± 46.9	0.17	0.62
P-value	0.37	0.000				

**N.B.:** P = difference between same group pre and post, P1 = difference between control and study groups pre, P2 = difference between control and study groups post implementation of the program, statistically significant P < 0.05.

Al-Rasheedi, 2014 reported that Joslin in the early 1920's stated that "the diabetic, who knows the most, lives the longest". Also the American diabetes association 2011 confirmed this by recent data that patient education has great efficiency in improving metabolic control.

In concordance with the current study results; Pereira et al., 2012 reported satisfactory results regarding the increase in disease knowledge, and the stimulation of reflections on the disease. This allowed the intervention group participants in their study to develop self-care measures related to changing their behavior, adopting healthy habits and practicing physical activity.

In complete agreement with our results; Sung et al., 2016 concluded that there was a significant difference in diabetes knowledge between the intervention group and the control group after education. Also in the same line Lee et al., 2002 reported a significant difference in the knowledge level of diabetic patients immediately after discharge, after three months, and after six months. Furthermore, Lee et al., 2008 reported that most diabetes education programs result in improved knowledge on diabetes outcomes.

Osborne et al. 2007 are in complete agreement with our results as they reported that teaching patients through educational programs improve their knowledge-based skills and techniques {including the use of equipment} and help them manage their disease-related symptoms and health problems.

## 9. Conclusion

This current study demonstrates the effectiveness of applying a health education program on the outcomes of type I diabetic patients in terms of improved knowledge and practice and an improved glycemic control.

## 10. Recommendations

Implementation of such education program on regular bases should take place as a strategic program for caring of diabetic patients.

Implementation of this health education program on a larger probability sample for randomization of the results.

Making available of a community health nurse for follow up of diabetic patients who are not able to visit the hospital or the health care centers for early detection and prevention of diabetes complications.

## 11. Source of Funding

None.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.



## Acknowledgement

The author is very thankful to the Deanship of Scientific Research, Prince Sattam bin Abdulaziz University for supporting this work.

## References

- Al-Rasheedi, A.A., 2014. The role of educational level in glycemic control among patients with type II diabetes mellitus. *Int. J. Health Sci. (Qassim)* 8, 177–187.
- AL-Shahrani, A., 2018. Impact of health education program on diabetic control among diabetic patient managed at diabetic and endocrine center in Bisha, Saudi Arabia. *Biomed. Res.* 29(11), 2391–2394.
- American Diabetes Association, 2011. Standards of medical care in diabetes 2011. *Diabetes Care* 34, 11–61.
- Atkinson, M.A., Eisenbarth, G.S., 2001. Type 1 diabetes: new perspectives on disease pathogenesis and treatment. *Lancet* 358 (9277), 221–229.
- Betterle, C., Dal Pra, C., Mantero, F., Zanchetta, R., 2002. Autoimmune adrenal insufficiency and autoimmune polyendocrine syndromes: autoantibodies, autoantigens, and their applicability in diagnosis and disease prediction. *Endocrinol. Rev.* 23, 327–364.
- Davies, M.J., Heller, S., Skinner, T.C., Campbell, M.J., Carey, M.E., Cradock, S., et al., 2008. Effectiveness of the diabetes education and self-management for ongoing and newly diagnosed (DESMOND) program for people with newly diagnosed type 2 diabetes: cluster randomized controlled trial. *Br. Med. J.* 336 (7642), 1–11.
- Ferguson, S., Swan, M., Smaldone, A., 2015. Does diabetes self-management education in conjunction with primary care improve glycemic control in hispanic patients? A systematic review and meta-analysis. *Diabetes Educ.* 41(4), 472–484. <https://doi.org/10.1177/0145721715584404>.
- Funnell, M.M., Brown, T.L., Childs, B.P., Haas, L.B., Hoseney, G.M., Jensen, B., Maryniuk, M., Peyrot, M., Piette, J.D., Reader, D., Siminerio, L.M., Weinger, K., Weiss, M.A., 2008. National standards for diabetes self-management education. *Diabetes Care* 31 (Supplement 1), S97–S104.
- Gautam, A., Bhatta, D.N., Aryal, U.R., 2015. Diabetes related health knowledge, attitude and practice among diabetic patients in Nepal. *BMC Endocr. Disord.* 15: 25. <https://doi.org/10.1186/s12902-015-0021-6>
- Gimenes, H.T., Zanetti, M.L., Haas, V.J., 2009. Factors related to patient adherence to antidiabetic drug therapy. *Rev. Latino-Am. Enfermagem* 17 (1), 46–51.
- Jarvis, J., Skinner, T.C., Carey, M.E., Davies, M.J., 2010. How can structured self-management patient education improve outcomes in people with type 2 diabetes? *Diabetes Obesity Metabolism* 12(1), 12–19.
- Kuijpers, W., Groen, W.G., Aaronson, N.K., Harten, W.H., 2013. A systematic review of web-based interventions for patient empowerment and physical activity in chronic diseases: relevance for cancer survivors. *J. Med. Internet Res.* 15(2): e37. <https://doi.org/10.2196/jmir.2281>
- Lee, E.J., Choe, Y.M., 2016. A study on subjective perception in elderly volunteers on volunteering as social participation: focusing on Q-methodology. *Instit. Soc. Sci.* 28, 143–173.
- Lee, Y.R., Kang, M.A., Kim, P.G., 2008. The effects of an admission-education program on knowledge, self-efficacy, self-care and glucose control in Type 2 diabetes patients. *J. Kor Acad. Soc. Nurs. Educ.* 1, 12–19.
- Lee, J.S., Kim, J.Y., Mun, H.G., Lee, J.R., Kim, S.A., 2002. Actual performance of self-monitoring of blood glucose by diabetic patients. *J. Kor Clin. Nurs. Res.* 8, 99–115.
- Mansyur, C.L., Rustveld, L.O., Nash, S.G., Jibaja-Weiss, M.L., 2015. Social factors and barriers to self-care adherence in Hispanic men and women with diabetes. *Patient Educ. Counsel.* 98 (6), 805–810.
- McEwen, L., Ibrahim, M., Ali, N., Assaad-Khalil, S., Tantawi, H., Nasr, G., et al., 2015. Impact of an individualized type 2 diabetes education program on clinical outcomes during Ramadan. *BMJ Open Diabetes Res. Care* 3: e000111.
- Osborne, Richard H., Elsworth, Gerald R., Whitfield, Kathryn, 2007. The Health Education Impact Questionnaire (heiQ): An outcomes and evaluation measure for patient education and self-management interventions for people with chronic conditions. *Patient Educ. Counsel.* 66 (2), 192–201.
- Pereira, D., Costa, N., Sousa, A., Jardim, P., Zanini, C., 2012. The effect of educational intervention on the disease knowledge of diabetes mellitus patients. *Rev. Latino-Am. Enfermagem* 2012 May–June 20(3), 478–485.
- Rushakoff, R.J., Sullivan, M.M., Seley, J.J., Sadhu, A., O'Malley, C.W., Manchester, C., Peterson, E., Rogers, K.M., 2014. Using a mentoring approach to implement an inpatient glycemic control program in United States hospitals. *Healthcare* 2 (3), 205–210.
- Shaw, J.E., Sicree, R.A., Zimmet, P.Z., 2010. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res. Clin. Practice* 87 (1), 4–14.
- Sung, K., Nam, J., Yu, M., 2016. The effects of a health mentoring education program on diabetes management for older adults. *Health Educ. Care* 1(2), 45–51.
- Torres, H., Pace, A., Chaves, F., Velasquez-Melendez, G., Reis, I., 2018. Evaluation of the effects of a diabetes educational program: a randomized clinical trial. *Rev. Saude Publica.* 52, 8.
- Utz, S.W., Williams, I.C., Jones, R., Hinton, I., Alexander, G., Yan, G., Moore, C., Blankenship, J., Steeves, R., Norman Oliver, M., 2008. Culturally tailored intervention for Rural African Americans with type 2 diabetes. *Diabetes Educ.* 34 (5), 854–865.
- Watts, S.A., Roush, L., Julius, M., Sood, A., 2016. Improved glycemic control in veterans with poorly controlled diabetes mellitus using a Specialty Care Access Network-Extension for Community Healthcare Outcomes model at primary care clinics. *J. Telemed Telecare* 22(4), 221–224. <https://doi.org/10.1177/1357633X15598052>.
- Wild, S., Roglic, G., Green, A., Sicree, R., King, H., 2004. Global Prevalence of Diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care* 27 (5), 1047–1053.
- World Health Organization – Diabetes country profiles, 2016. [https://www.who.int/diabetes/country-profiles/egy\\_en.pdf](https://www.who.int/diabetes/country-profiles/egy_en.pdf)
- World Health Organization, 2006. <https://www.who.int/ipcs/publications/ehc/ehc236.pdf>.

## Further Reading

- Sohn, N.Y., Yang, J.H., 2013. Factors influencing self-care behaviors related to insulin therapy in elders with diabetes mellitus. *J. Kor Acad. Soc. Nurs. Educ.* 20, 27–36.
- Whiting, D.R., Guariguata, L., Weil, C., Shaw, J., 2011. IDF Diabetes Atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res. Clin. Practice* 94 (3), 311–321.