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Evaluation of the effect of self-care behavior training on glycosylated hemoglobin (HbA1c) levels in diabetic patients

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ABSTRACT

Background: Successful management of blood glucose levels is one of the most important factors in the health of diabetic patients. Evidence suggests that poor self-care is the leading cause of mortality and complications in diabetic patients; therefore, these individuals require improved self-care knowledge. With this background in mind, this study aimed to evaluate the effect of self-care training on glycosylated hemoglobin (HbA1c) levels in diabetic patients.

Methods: This clinical trial was conducted on 80 diabetic patients referring to the Bandar Abbas diabetic clinic, selected by random sampling and allocated to two groups of intervention and control using stratified random sampling. In the intervention group, a designed group training program was carried out for nine 60-minute sessions once a week for 12 weeks. Subjects in the control group received usual care of the clinic. Data were collected using a demographic questionnaire and HbA1c test prior to and at the end of the study. Data analysis was performed in SPSS version 18 using Mann-Whitney U, Chi-square, and independent and paired t-test.

Results: Before the intervention, mean HbA1c levels in the intervention and control groups were 8.18±1.66 and 8.41±2.10, respectively. However, after the intervention these values reached 7.78±1.48 and 8.82±2.11, respectively (P=0.01).

Conclusion: According to the results of this study, implementation of self-care training program led to a significant reduction in HbA1c levels in the samples. Therefore, nurses and other healthcare providers could take advantage of this approach as an appropriate educational method to efficiently manage diabetes in patients.

1. Introduction

Diabetes is known as one of the most important health challenges, significantly affecting the daily life of the patients.[1] The progressive nature of chronic diseases need special attention; accordingly, diabetes has been referred to as a "silent epidemic" by the World Health Organization (WHO).[2]

In 2013, number of diabetic patients reached a population of 382 million in the world, expected to increase to 592 million by 2035. Statistics have revealed that 9.9% of total population were diagnosed with diabetes in 2013 in Iran. However, this number is expected to reach 10.1% by 2035.[3]

Not only is diabetes associated with premature disabilities and increased mortality, but it is also one of the leading causes of blindness in adults. In addition, diabetic patients are at a higher risk of hypertension and cardiovascular complications, compared to healthy individuals.[4] Given the rising prevalence and widespread complications of diabetes, efforts have been made to identify a treatment for this disease; however, no definitive treatment method has been recognized yet. The most important strategy used to manage this disease is to keep blood glucose levels in the normal range through the application of adjustable factors. It should be noted that a large part of this process is through self-monitoring. Several studies have suggested that in the process of chronic disease management, the primary responsibility rests within the patient and family caregivers, and there is little need for specialized services.[4-6] Therefore, self-care is considered as the main contributing factor for adequate management of this disease.[4]

Self-care behaviors include a healthy dietary regimen, engagement in physical activities, adherence to drug regimen, blood glucose monitoring and foot care.[5] Literature review has revealed that these measures could increase the quality of life, decrease the number of hospitalized cases, and prevent or delay acute and chronic complications associated with diabetes.[6]

In this regard, monitoring of blood glucose and glycosylated hemoglobin (HbA1c) is considered as the specific index of self-care behavior evaluation and could be used as a beneficial indicator of mean blood glucose levels in the past 8-12 weeks.[7] Use of HbA1c index has eliminated the problem of day-to-day variation in blood glucose levels. Additionally, this index could be applied to measure glucose levels in patients every day and no preparation (e.g., fasting) is needed prior to its application.[8]

In this regard, lower HbA1c levels are indicative of better monitoring of blood glucose. To clarify, it could be stated that a one-percent reduction in the amount of HbA1c leads to 40% decrease in the associated complications.[9] On the other hand, high HbA1c levels show that the patient is at risk of microvascular complications, and attempts should be made to enhance the monitoring of blood glucose levels.[7] Therefore, it seems that management of such complications requires suitable patient empowerment through self-care behaviors. Nurses play a pivotal role in training and empowering patients in terms of self-care behaviors, adequate monitoring of blood glucose levels and enhanced quality of life,[10] which comes with no surprise since education is one of the major roles of healthcare team members, including nurses.[11]

According to the literature, application of different educational methods has diverse effects on various individuals and groups; therefore, these contradictory effects must be evaluated by researchers.[12] Some of the educational interventions regarding HbA1c monitoring are as follows: combined training (e.g., lectures, group discussions and educational videos),[13] training through team-based nursing models,[14] home visits by nurses,[15] nurse-led telephone follow-up,[16, 17] educational therapy through training packages and text messages[18] and application of nurses' problem-solving skills.[19]

In a study by Aghamolayi et al. (2003),[20] it was demonstrated that diabetic patients, referring to Bandar Abbas Diabetic Clinic, had inadequate self-care behaviors and just 2.5% of them had optimum metabolic control. In addition, researchers of the aforementioned study emphasized the importance of development and implementation of educational programs. Results of recent research in local databases are indicative of the limited number of studies on the evaluation of the effect of training program implementation by nurses without the assistance of other healthcare providers. Given the specific role of nurses in terms of self-care behavior training for diabetic patients, the present study aimed to evaluate the effect of self-care training on HbA1c levels in diabetic patients.

2. Methods

2.1. Design

This clinical trial was conducted on patients with diabetes type II, referring to the diabetic clinic of one of the teaching hospitals of Bandar Abbas, Iran in 2015.

2.2. Participants and setting

In this study, Sample size was calculated at 38 patients per group based on the mean comparison formula ($Z_{1-\alpha/2}=1.96$, $Z_{\beta-1}=1.28$, $\sigma=1.75$, $d=1.3$) and the results obtained by Sadeghi et al. (2010)[21] Considering possible sample loss, the final sample population was estimated at 80 patients (40 patients per group).

Participants were selected based on random number tables (consisting of a list of patients referring to diabetic clinic) and allocated to two groups of intervention and control via stratified sampling. First, categories were determined based on the important variables of study, including HbA1c and gender. Afterwards, the first participant was randomly assigned to a study group (intervention or control), followed by the allocation of the next sample to the group with lower total values in variables (HbA1c level and gender). However, samples were randomly selected again in case of equality in the sample size of the groups.

Inclusion criteria were diagnosis of diabetes type II within the past six months, age range of 40-65 years, no acute or chronic physical (e.g., debilitating cardiac, respiratory, liver, kidney and skeletal muscle diseases) and mental impairments (according to medical records), and residence in Bandar Abbas. The only exclusion criterion was lack of regular participation in training courses.

2.3. Instruments

Study tools were demographic questionnaires and a UV2800 UV-VIS spectrophotometer (Mindray Co., China), used to measure the level of HbA1c. This device was calibrated before the measurement, and test-retest reliability method was used to determine its reliability. To do so, a blood sample was divided into two parts, followed by the separate demonstration of HbA1c levels in each sample using

the mentioned device. Finally, the Pearson's correlation-coefficient between the two measurements was estimated at 0.86.

2.4. Data Collection

In this study, After sample collection, participants were asked to complete the demographic questionnaire (age, gender, educational level, duration of disease) through face-to-face interviews at the diabetic clinic before the intervention. Following that, 0.5-1 cc blood sample was collected from all the patients to determine HbA1c levels.

The training program was carried out in the form of nine 60-minute sessions by the researcher for the intervention group. Duration of this intervention course was 12 weeks; in the first six weeks, one group-training session was provided for the participants each week (Table 1). On the other hand, these sessions were carried out within prolonged intervals (one session every other week), and the materials presented in the first six weeks were reviewed in each of these 60-minute sessions.

Participants were informed of the first session through a phone call, and other sessions were fixed during each of the sessions. Educational content of the program was developed based on diabetic patients' needs, especially those related to self-care behaviours, inspired by previous findings in this regard, such as the studies by Tang et al. (2011)[22] and Krebs et al. (2013)[23] (Table 1). Meanwhile, samples in the control group only received routine training of the center. After 12 weeks and with a phone call, participants were asked to visit the center to collect blood samples by the same method used before the intervention. In addition, HbA1c levels in both groups were estimated using spectrophotometer with the mentioned specifications.

2.5. Ethical considerations

Written informed consent was obtained from all the participants prior to study and based on the approval of Research Ethics Committee of Rafsanjan University of Medical Sciences. Moreover, objectives of the study were explained to the subjects, and they were assured of confidentiality terms.

2.6. Statistical analysis

Data analysis was performed in SPSS version 18 using descriptive statistics (mean and standard deviation), Chi-square (to compare the study groups in terms of gender and education level), Mann-Whitney U test (to compare both groups in terms of age and duration of disease), independent T-test (to compare both groups regarding HbA1c levels), and paired T-test (for intragroup comparison of the groups before and after the intervention in terms of HbA1c levels).

Table 1. Content of training sessions

Sessions	Topics	Content
Session one	Definition of diabetes	Understanding diabetes and signs and symptoms associated with hyperglycemia, clarifying the importance of self-care behaviors Recognition of chronic and acute complications of diabetes, hypoglycemia and hyperglycemia management, prevention of diabetes complication through identifying its causes
Session two	Nutrition	Discussing the importance of food regimen, identifying the major food groups and their impact on blood glucose levels, recognition of carbohydrate sources and their effect on blood glucose levels
Session three	Nutrition	Identifying strategies to improve blood glucose, blood pressure, cholesterol and weight management through healthy food regimen, creating a functional diabetes program
Session four	Pharmaceutical consumption	Expressing the role of medication in diabetes, clarifying the advantages and complications associated with diabetes medications, discussing oral diabetes medication guide, learning the insulin injection procedure, learning the proper insulin injection technique
Session five	Physical activity and blood glucose monitoring	Describing the positive effects of regular physical activities on blood glucose levels, defining the special steps diabetic patients need to take before any exercise, translating the blood glucose test results, identifying the possible responses to the results of blood glucose monitoring
Session six	Associated complications and foot care	Demonstrating the importance of foot care, describing foot care measures, discussing the importance of using proper footwear, identifying risk factors for long-term complications

3. Results

Demographic characteristics of the study population are presented in Table 2. According to this table, no statistically significant difference was observed between the study groups in baseline variables.

In the next stage of intervention, results were indicative of a significant decrease in mean HbA1c levels in the intervention group (7.78±1.48), compared to the control group (8.82±2.11) (P=0.01). Intragroup comparison based on paired T-test revealed that mean HbA1c levels were

significantly lower in the intervention group, compared to before the intervention (P=0.02); meanwhile, no such difference was observed in the control group (Table 3).

Table 2. Demographic characteristics of patients

Variable	Group	Intervention N (%)	Control N (%)	P-value
Gender	Male	16 (40.0)	15 (37.5)	*0.50
	Female	24 (60.0)	25 (62.5)	
Education level	Illiterate	17 (42.5)	14 (35.0)	*0.14
	Below diploma	17 (42.5)	11 (27.5)	
	Diploma	2 (5.0)	9 (22.5)	
	Above diploma	4 (10.0)	6 (15.0)	
Age (year)	40-55	18 (45.0)	27 (67.5)	**0.51
	56-65	22 (55.0)	13 (32.5)	
	M±SD	56.47±6.54	52.65±6.27	
Duration of disease (year)	1-10	23 (57.5)	24 (60.0)	**0.57
	11-20	11 (27.5)	14 (35.0)	
	21-30	6 (15.0)	2 (5.0)	
	M±SD	11.75±8.22	10.05±5.92	

*Chi-square; ** Mann-Whitney U test

Table 3. Comparison of mean HbA1c levels in diabetic patients of both groups before and after the intervention

Time \ Group	Intervention M±SD	Control M±SD	*P
Before the intervention	8.18±1.66	8.41±2.10	0.58
After the intervention	7.78±1.48	8.82±2.11	0.01
**P-value	0.02	0.06	

*Independent t-test; **paired t-test

4. Discussion

According the results of the present study, a significant reduction was observed in HbA1c levels in diabetic patients through self-care behavior training by nurses. In this regard, Rakhshanderoo et al. (2009) evaluated the effects of educational interventions on metabolic control of diabetic patients. According to the results obtained in the mentioned study, level of HbA1c significantly decreased after the intervention, which is in line with our findings.[24] Despite the similarity in the educational content of the current study and the mentioned research, there was a lack of consistency between the groups in terms of the number of training sessions, trainers, and applied methods. In the mentioned study, a group of physicians, nutritionists and the researcher were responsible for the training process, using lectures, group discussions, videos, pamphlets and booklets to teach the participants as a single group. However, since the large number of trainers led to difficulties in controlling the intervention sessions, the training sessions in the present study were carried out with only one expert to increase the effectiveness of intervention and facilitate its process.

In a study by Kashfi et al. (2009), it was demonstrated that training of diabetic patients led to a significant reduction in the level of HbA1c,[25] which is in congruence with the results obtained in the present study. However, there was a difference between the two studies in terms of the educational content, training sessions and research environment. In this regard, training sessions in the aforementioned study were limited to nutrition and walking, carried out for one month in the form of six one-hour sessions. On the other hand, these training sessions were held in the form of nine sessions for 12 weeks in the current research. Given the fact that successful self-care behaviors and management of diabetes are not limited to food regimen and exercise, other aspects of self-care behaviors with significant role in adequate patient monitoring were evaluated in the present study as well, and training requirements were provided for the patients in this regard.

In another study by Farhandi et al. (2015), six training sessions, consisting of lectures, FAQ, group discussions, educational videos and pamphlets for six consecutive months caused a significant decrease in the level of HbA1c and blood pressure in the intervention group.[13] While the results of the mentioned study are consistent with our findings, there was a difference between the studies in terms of educational content and type of presentation.

In line with the results of the current study, group counseling was associated with the significant reduction of HbA1c levels in the samples in a study by Mazloom et al. (2015).[7] Nevertheless, a difference was observed between the

aforementioned study and the current research in terms of educational method and duration of each training session, which were held in the form of five sessions (one hour and a half each). In addition, training sessions were carried out by a specialized consultant (PhD in clinical psychology) in the mentioned study, whereas they were held by a nurse and through lectures and group discussions in the present study. It was concluded that not only did the application of these methods engage the participants in the learning process, but the required information was also provided through lectures for patients, and possible questions were responded in order to remove any ambiguity in the content.

Jalilian et al. (2011) conducted a study to evaluate the effects of self-care training programs on self-management of diabetic patients. According to the obtained results, implementation of six 60 minute training sessions in the form of lectures and group discussions led to a significant increase in the mean self-care score of the samples after the intervention.[26] While the results of the aforementioned study are in congruence with our findings, application of surveys was substituted by the evaluation of HbA1c levels in the current research for higher accuracy in assessing the improvement of self-care behaviors in the participants.

Several foreign studies have been conducted on this subject proposing similar results. In this regard, the results obtained by Scain et al. (2009)[27] and Kyzer et al. (2008)[28] were indicative of a significant reduction in HbA1c levels, which is in line with the findings of the present study. With regard to the results of previous studies, as well as our research, it could be concluded that self-care training has a significant impact on blood glucose monitoring in diabetic patients.

In this study, some of the limitations were lack of generalizability of the results due to the small sample size and approaches used to conduct the study. Moreover, differences in the demographics of the samples might have affected the results, which cannot be controlled by the researcher.

5. Conclusion

According to the results of this study, self-care training could significantly decrease HbA1c levels in diabetic patients and be used by nurses as a beneficial intervention. Therefore, given the chronic nature of diabetes and further follow-up requirements and considering the results of the present study and previous research, this method could be used alongside other educational techniques to train diabetic patients. However, it is recommended that future studies be conducted to compare the effects of this method with other educational programs.

Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions

Zakieh Ahmadi: design of research, implementing training sessions, data collection, preparation of initial drafting. Tabande Sadeghi: assistance in research design, guiding the research implementation, data analysis, participation in manuscript drafting. Marziyeh Loripoor: assistance in research design, guiding the research implementation, participation in manuscript drafting. Zahra Khademi: study consultant, assistance in data collection, participation in manuscript drafting.

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