Research Article

The Effect of Flipped Learning Method on Self-care of Patients with Type 2 Diabetes

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Abstract

Background: One of the reasons for the lack of success and desired treatment results in diabetic patients is their lack of participation in treatment. Diabetes self-care education is a key factor in the prevention and treatment of diabetes, which is effective in improving the patient's quality of life (QoL) and cost reduction.

Objectives: This study aimed to determine the effect of the flipped learning method on the self-care of patients with type-2 diabetes referred to the Diabetes Clinic of Bu-Ali Hospital in Zahedan.

Methods: A semi-experimental study was conducted on 114 diabetic patients. The participants were randomly divided into intervention and control groups, and a pre-test was administered. The self-care of diabetes index (SCODI), 40 items, was completed before and after the intervention by the research samples. The flipped learning program was conducted as an intervention in five sessions for patients in the intervention group, and a post-test was administered two months after the completion of the educational intervention. The obtained data were analyzed by SPSS 26. The significance level was considered less than 0.05.

Results: Two months after the flipped learning intervention, the findings showed more positive changes in the flipped learning method in increasing the patients' self-care in the intervention group (P > 0.001). The mean score of self-care and its variations mean was significantly higher in the intervention group in the post-test than in the control group (P = 0.001).

Conclusions: Implementing flipped learning positively affects increasing self-care in diabetic patients. It seems that the implementation of such programs can play an effective role in the treatment and prevention of type-2 diabetes complications.

Keywords: Flipped Learning, Type-2 Diabetes, Self-care

1. Background

Diabetes is the most common disease caused by metabolic disorders, which occurs with an increase in blood sugar and causes damage to the vital organs of the affected person, brings about kidney failure, retinopathy, and neuropathy, and ultimately shortens the life span of the affected patients (1). Today, diabetes is considered one of the most important health-medical and socio-economic problems in the world (2). Diabetes is the sixth cause of death worldwide, and type-2 diabetes accounts for approximately 85 - 90% of diabetic patients (3). According to the statistics of diabetes worldwide, the World Health Organization (WHO) declared it a latent epidemic. According to the estimate of the International

Diabetes Federation, 387 million people in the world are suffering from diabetes, and they attributed about 9.4 million deaths to this disease in 2014. It is estimated that by 2030, the number of people suffering from this disease will be about 552 million (4-6). According to statistics, one out of every five Iranians has diabetes or has a high risk of developing diabetes. It is predicted that in 2030 Iran will rank second in the region after Pakistan (6, 7), so prevention programs are very important to reduce its speed.

Compared to other chronic diseases, diabetes requires more self-care, and 95% of diabetes care is the patient's responsibility (7). Self-care is those activities people do independently to promote and maintain their health

(8). In diabetes, the successful control of diabetes mainly depends on the patient's self-care, and the treatment team has little control over the patient in the intervals between visits (9). Self-care for diabetic patients includes controlling and monitoring blood glucose levels, exercise and physical activities, nutrition and diets, smoking cessation, foot care, and regular use of medications (10). Deficiency in self-care is the most important factor in increasing the complications of diabetes; as a result, it causes the death of affected patients (11). Numerous studies on diabetes have shown that only a small proportion of chronic diseases such as diabetes are cared for by professional medical staff (1, 12, 13). Hence, it is necessary to change the behavior of diabetic patients.

The promotion of self-care is possible through active education (14). Education in type-2 diabetes is one of the basic components of nursing care, traditionally offered face-to-face. Another traditional method of teaching the patient is using written tools such as pamphlets and educational booklets (15, 16). Passive learning in traditional educational methods, such as lectures, can be boring for learners and deprive them of rich educational experiences (17). Lack of knowledge can be a problem, but the criticism of the traditional model is that reflection, interaction, and the patient's understanding have not been considered in it (18). So, there is a need for an educational method considering the possibility of interaction with the patient and feedback from his learning (19).

A new comprehensive educational method is "flipped learning." In this method, the instructor provides the educational content that is supposed to be taught to the learners during a session, and the learners must learn the content presented to them in an environment other than the classroom and then attend the training class (17). In this method, the training class is a place to discuss the learners' knowledge. Training sessions include solving learners' problems, questions and answers, and practice. Since the activities that should take place outside the training session replace teaching in the training session, this method is called flipped learning (20).

Flipped learning is an inclusive educational method; in this educational method, activities before the educational program are focused on supporting lower cognitive levels (such as knowing and understanding). Therefore, classroom time is used to achieve higher levels of learning (such as application and analysis) (21, 22). In this educational method, by solving the patient's problems in the educational session and ensuring complete learning, the educational needs of the patients are met (23). The type of teaching to the patient and how it is done are important in accepting the disease and understanding the behavioral changes required for active participation in the treatment (23). In the flipped learning method, the learners observe the content before the training and study before the training session and enter the session prepared for collaborative learning. The precious time of the training session is also spent on active learning, such as individual exercises, discussions, and case studies. This flipped approach guarantees inclusive activeness in the training session; in this method, you can study before the training session, and then they will appear in the class. While there is no question and answer in the training session through the smartphone (21, 23, 24). Considering the chronic, non-contagious, and costly nature of diabetes and creating a large financial burden, it seems necessary to pay attention to self-care education in diabetes and its consequences (25).

2. Objectives

The present study was designed to determine the effect of the flipped learning method on the self-care of patients with type 2 diabetes since the treatment of a chronic disease depends to a large extent on the self-care behavior of individuals (2, 26) and various studies show that the self-care status of diabetic patients is not at an acceptable level, i.e., they do not perform self-care completely and regularly, and patients have little self-care ability (27, 28), and also considering the importance of diabetes and its prevalence in society, its complex complications, and the loss in the economic power of families.

3. Methods

A semi-experimental intervention was conducted. The research population consisted of type-2 diabetic patients referring to the Diabetes Clinic of Bou-Ali Hospital of Zahedan, Iran, who visited this center in 2021 to receive periodical care. For this purpose, after obtaining permission and coordination with the university and hospital authorities, patients referred to the diabetes clinic were selected conveniently and then randomly assigned to the intervention and control groups using cards. The sample size was estimated based on the mean and standard deviation of the self-efficacy score in the study of Chang and Dai and with a confidence limit of 95% and a statistical test power of 80%, and based on the following formula, 52 people in each group were estimated (29). Considering the possible loss of the sample size, 57 people were determined in each group and a total of 114 people. The intervention group received self-care training in five sessions with the flipped learning method, and

the control group received the center's routine training. Subjects were informed regarding how to conduct the study and the purpose of the study and were ensured about the confidentiality of information; also, a written informed consent form was obtained from all patients. The data collection tool was a printed questionnaire, and the data was collected by completing the questionnaire during the direct study and on two occasions before the educational intervention and two months after education. The questionnaire used consisted of two parts:

(1) Demographic and background questions: This part included nine items and evaluated patients' information regarding age, gender, education level, duration of illness, occupation, marital status, insurance, ethnicity, and the main caregiver;

(2) The self-care of diabetes index (SCODI): This is a standard questionnaire and contains 40 items measuring behaviors related to patients' self-care (smoking, having suitable physical activity, personal blood sugar measurement, foot care, regular weight control, adherence to diet, and regular use of medications or insulin for diabetics). The total score of this questionnaire was 200; higher scores showed more self-care in the patient. SCODI measures self-care behaviors in patients with type-II diabetes. The translation and validation of SCODI in Persian provide researchers with a reliable tool for the Iranian diabetes population, and its face and content validity and structure have been confirmed by Ebadi et al. Its reliability was measured and confirmed by Cronbach's alpha (0.8) in that study (30). In this study, the reliability of the tool was measured using Cronbach's alpha (0.8).

3.1. Conducting Educational Intervention

The basis of educational planning in this study was active learning; we tried to make the patients actively participate in the educational program during the educational intervention. The training program for the intervention group was held in five sessions in the form of a 15-min educational video and a 20-min face-to-face session in the form of a group discussion of two to four about the video of that session. The topics discussed included the complications of diabetes, the benefits of self-care in preventing complications, the importance of physical activity, diet, and foot care, and the complications of smoking in diabetes. Training sessions were held from 10 to 12 h. The control group received the routine educational interventions of the diabetes center. In both groups, two months after completing the training course, the self-care questionnaires were completed again by the researcher and the researcher's assistant to the patients. In order to achieve the goal of the research, the information related to the main research variable (self-care) was examined as a pre-test and a post-test with an interval of two months in the intervention and control groups. Mean, standard deviation, frequency, and percentage were determined using descriptive statistics. Paired *t*-test was used for the before and after comparisons. An independent *t*-test was used to compare the intervention and control groups. Specific data were analyzed using SPSS 26. The independent *t*-test was used to compare the mean of quantitative variables between two groups, and the chi-square test and Fisher's exact test were used to compare the frequency of qualitative variables between two groups. The significance level was considered less than 0.05. Ethical considerations were completing the written informed consent form for participating in the research and the participants' right to withdraw from the research for each unit; the ethical code in this research was IR.ZAUMS.REC.1400.395.

4. Results

The statistical findings showed that in implementing the educational program, the control and intervention groups were matched regarding background factors such as age, gender, level of education, duration of illness, occupation, marital status, and main caregiver. These two groups had no statistically significant differences (Tables 1 and 2). The results of the independent t-test showed that the mean and standard deviation of the self-care score of the patients in the two intervention and control groups were significantly different before training (P = 0.001) (Table 3), and the mean self-care score and its variations mean in the intervention group in the post-test were significantly higher than the control group (P = 0.001) (Table 3). The mean and standard deviation of the self-care score variations in the intervention group (29.77 ± 12.96) were significantly higher than the control group (4.96 ± 5.56) (P = 0.001) (Table 3). The result of the analysis of the covariance test to control the significant effect of pre-test scores showed that the mean self-care score of diabetic patients in the two groups was significantly different after self-care training, as the self-care score of the intervention group patients was significantly higher than the control group (P = 0.001) (Table 4). The findings have been checked for normality, and they were normal.

5. Discussion

Diabetes is a disease for which the patient is responsible for most of his treatment, and patients need to have high self-care and knowledge in various

Table 1. Comparison of the Mean Values of Quantitative Variables in the Intervention and Control Groups of Diabetic Patients Referring to the Diabetes Clinic

Statistical Indices of the Groups	Frequency	Minimum	Maximum	Mean ± Standard Deviation	Independent *t*-test		
					t	p	df
Age					0.23	0.81	112
Control group	57	52	49	39.3 ± 6.6			
Intervention group	57	24	49	39.6 ± 6.3			
Years of illness					1.10	0.27	112
Intervention group	57	2	17	7.7 ± 3.9			
Control group	57	1	17	6.9 ± 4			

Table 2. Mean Comparison of Qualitative Variables in the Intervention and Control Groups of Diabetic Patients Referring to the Diabetes Clinic [a]

Group	Intervention	Control	Chi-square Test Results		
			χ^2	df	P
Gender			0.32	1	0.57
Male	31 (54.4)	34 (59.6)			
Female	26 (45.6)	23 (40.4)			
Employment			0.41	1	0.83
Employed	40 (70.2)	39 (68.4)			
Unemployed	17 (29.8)	18 (31.6)			
Marital status			0.24	1	0.62
Married	46 (80.7)	48 (84.2)			
Single	11 (19.3)	9 (15.8)			
Education			0.35	3	0.94
High school education and lower	10 (17.5)	9 (15.8)			
Diploma	18 (31.6)	21 (36.8)			
Postgraduate	15 (26.3)	14 (24.6)			
Bachelor of Science and higher	14 (24.6)	13 (22.8)			
Caregiver			0.12	1	0.72
The patient's main caregiver	53 (93)	52 (91.2)			
The main caregiver for other people	4 (7)	5 (8.8)			

[a] Values are expressed as No. (%).

Table 3. Mean and Standard Deviation Comparison of Self-care Scores of Diabetic Patients Before and After Self-care Training in the Intervention and Control Groups [a]

Group	Before Intervention	After Intervention	Variations	Paired *t*-test		
				t	df	P
Intervention	60.78 ± 4.89	90.56 ± 13.82	29.77 ± 12.96	17.33	56	0.001
Control	58.42 ± 3.56	63.38 ± 6.15	4.96 ± 5.56	6.73	56	0.001
Independent *t*-test						
t	2.95	13.55	13.27			
df	112	112	112			
P	0.001	0.001	0.001			

[a] Values are expressed as mean ± standard deviation.

Table 4. The Results of Covariance Analysis Related to the Mean Score of Self-care of Diabetic Patients After Self-care Training with Control of the Pre-test Effect

Variations Source	Sum of Squares	Degree of Freedom	Sum of Squares	F	Significance Level	Effect Size	Test Power
Pre-test	1687.34	1	1687.34	16.81	001.0	132.0	982.0
Group	95.16560	1	95.16560	071.165	001.0	598.0	1
Error	36.626	111	326. 100				
Total	709315.09	114					

fields of treatment (31). Several studies have indicated that the educational program's implementation has positively affected the amount of self-care in type-2 diabetic patients, which is consistent with the results of the present study (31-33).

Flipped learning is one of the new methods of education. The study by Tune et al. showed that this method has positive effects on the overall performance of students and is more effective than the traditional method (34). This study manifested that the flipped learning method is a highly efficient educational method. Accordingly, its results are in line with the current results; however, the necessary cautions should be taken when comparing the two studies due to the obvious differences in the study population, the participant students and the patients in the current study, and the special conditions of each group that should be considered when training them.

Osterlie conducted a study to determine the effects of flipped learning on the motivation to learn physical activities and physical education in students (35). The educational content was provided to the students in three videos, each for 12 min. At the end of each video, a summary of the content of the next session was presented; the results showed that the flipped learning method had significant positive effects on the mentioned variables (35). This study revealed that the flipped learning method is a highly efficient training method in behavior training. The results of this study are in line with the present results. However, the necessary cautions should be taken when comparing the two studies due to obvious differences in the target society and the special conditions of each group in their education.

Sadeghi et al. compared the effect of the flipped learning method and multimedia on the physical activity of patients with open-heart surgery (36). This study was conducted on 60 patients, and the results showed that the mean duration of physical activity was not significantly different in the study groups before surgery, two days after surgery, and 5 - 6 days after surgery. However, the mean physical activity score on days 2 and 5 to day 6 in the post-surgery phase was significantly different in the flipped learning method and multimedia groups (36). Considering that both studies were conducted on patients, the results indicate the effectiveness of this method in the hospital, and it is consistent with the effectiveness of the flipped learning method in the present study.

Chang and Dai studied the effectiveness of the flipped learning program in improving self-management in patients with chronic obstructive pulmonary disease in Taiwan and showed that patients who received the flipped learning program for self-management had statistically significant improvements compared to the control group (29). These results indicated that the flipped learning method could be used to teach adult patients, and a nurse can practically use this self-management training program (29). In the control group, the paired *t*-test showed that the scores before and after were significantly different. Considering the effect of routine education given in the diabetes clinic and the possibility of receiving information from the outside environment, this can be justified, but the effect of the flipped learning method was significantly greater. According to the results of the present study and the effectiveness of remote training methods in improving the self-care behaviors of diabetic patients, it is suggested to apply this training method in comprehensive health service centers along with other training methods.

5.1. Limitations

Among the limitations of the current research, the individual differences of patients can be referred to and the amount of their previous knowledge about how to control blood sugar, manage side effects, and self-care methods that can affect the patients' self-care and performance, which were controlled to some extent by random allocation. Among other study limitations, low participation in the research project can be pointed out. Considering the advantages of remote training, their cost-effectiveness, and the current conditions of society and the spread of the coronavirus, medical and health centers should pay more attention to such training. Since the data were collected by self-reporting, the results may not reflect the participants' actual performance.

5.2. Conclusions

The results showed that the flipped learning method at the patient's bedside and self-care training is effective, so using this method is recommended considering the conditions and characteristics of the patients. As a result, nurses can educate patients by considering the educational facilities, the number of personnel, and the existence or lack of educational videos (considering that the flipped method is also used without educational videos).

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Footnotes

Authors' Contribution: All the authors contributed to conducting the study and drafting the manuscript.

Conflict of Interests: There was no conflict of interest in this study.

Ethical Approval: This research project was approved by Zahedan University of Medical Sciences with the code of ethics IR.ZAUMS.REC.1400.395 and the authors complied with all required protocols.

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Informed Consent: All patients signed an informed consent form.

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